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CRUISER ARMED WITH PNEUMATIC DYNAMITE GUNS.

In our issue of February 26 we presented a plan and longitudinal section of the cruiser now being built for the government by the Cramps, and which will be furnished with three of the pneumatic dynamite guns designed by Lieut. Zalinski. We herewith publish a perspective view of the boat, and give a few more details concerning its construction.

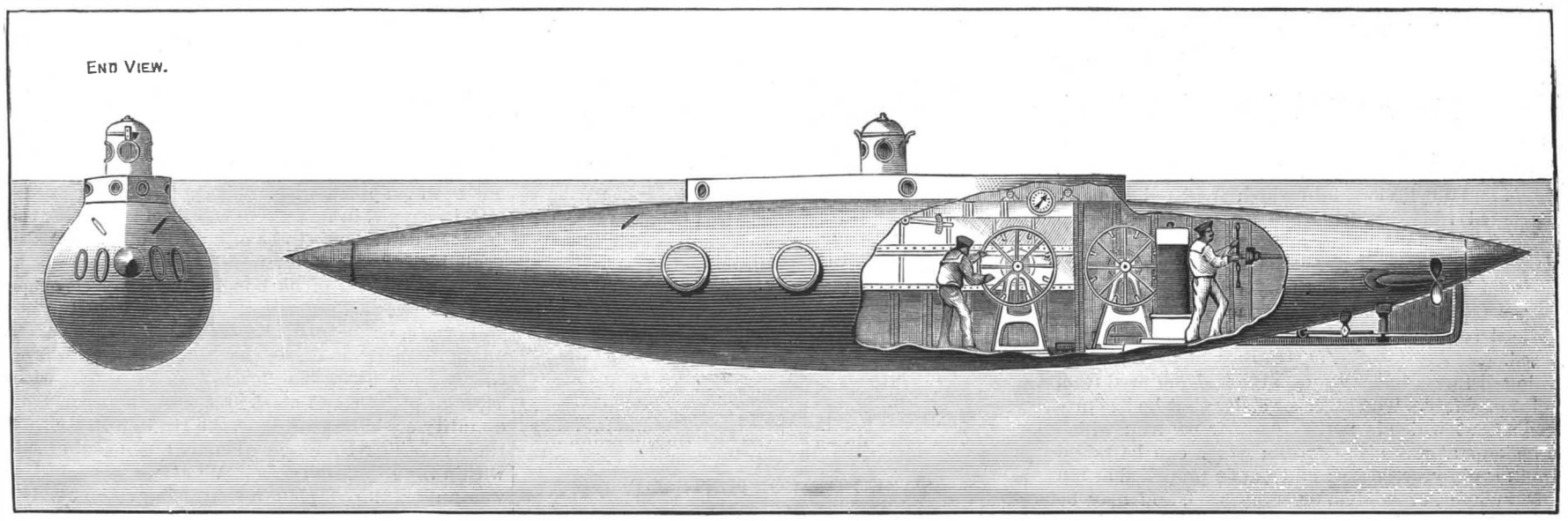
The air from the compressors passes to the main reservoirs, which, being located along the keel, occupy space which is of little value. The air is then conducted to an intermediate or firing reservoir, from whence it is admitted to the breech of either of the gun tubes. The storage reservoirs are designed to carry a pressure of 2,000 pounds to the square inch, while the intermediate will carry 1,000 pounds. The capacity of the reservoirs is such that thirty shots can be fired as rapidly as the guns can be loaded; and of these thirty shots, fifteen can be fired the full distance—which according to the contract must be one mile or over—and fifteen at close quarters, which means one thousand yards or over.

The pilot steers, fires, and has absolute control of each of the independent engines driving the twin screws. This system, by doing away with the transmitting of orders by voice or signal, places all the machinery under the immediate control of one man, who is responsible for the handling of the boat, and who himself executes what, in the usual way, would be his own orders. The rapidity thus insured is of the utmost importance, while the danger of error arising through excitement, when the boat is under fire, is perhaps reduced by the placing of all the responsibility upon one man.

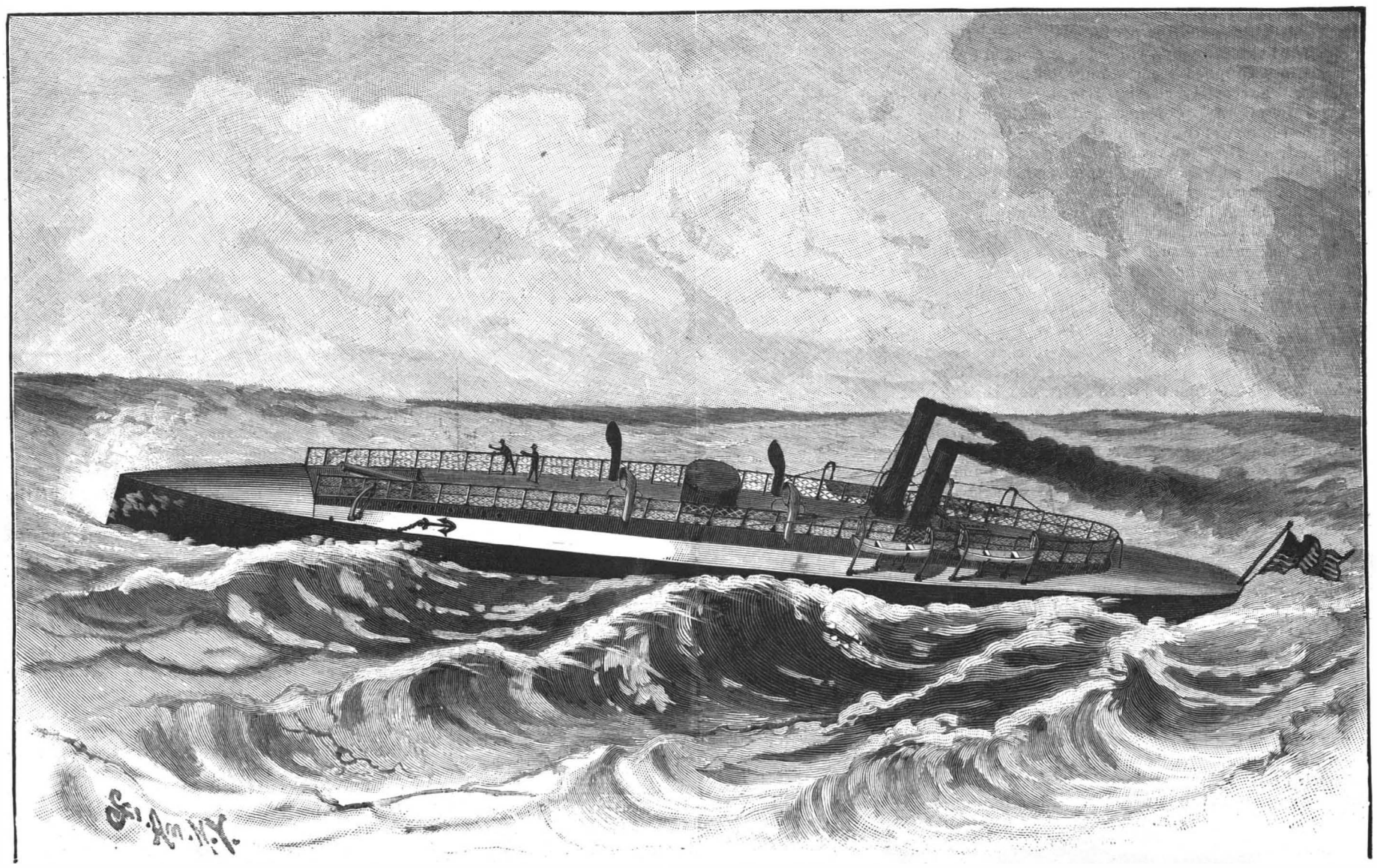
Contrary to the reports which have been circulated, the cruiser will be American from stem to stern, both in design and in the material entering into its construction. Judging from the many successful experiments that have been carried on with the dynamite gun now at Fort Lafayette, it is most probable that the new boat will meet the expectations of its projectors.

THE SUBMARINE BOAT NAUTILUS.

Our illustration represents the Nautilus, a boat designed for submarine movement by electric power, furnished with means of sinking and rising at will on the principle devised by Mr. Andrew Campbell, to whose ideas practical effect has been given by Mr. Edward Wolseley and Mr. C. E. Lyon. The boat has been constructed by Messrs. Henry Fletcher, Son & Fearnall, the well known shipbuilders, of Limehouse, and its action was successfully exhibited, two months ago, at the West India Docks, to Lord Charles Beresford, R.N., and other naval officers.



THE DISPLACEMENT SINKING AND RISING SUBMARINE BOAT NAUTILUS, WORKING BY ELECTRIC POWER.



CRUISER ARMED WITH PNEUMATIC DYNAMITE GUNS

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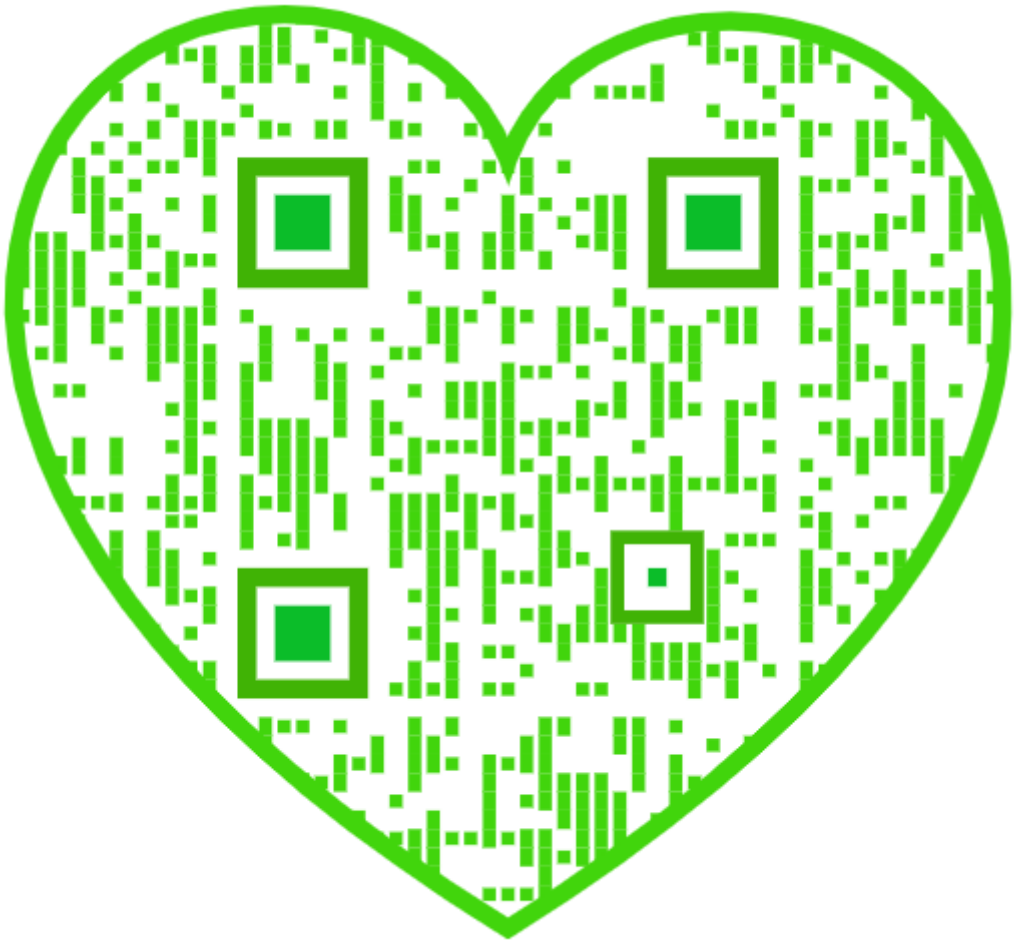

The torpedo, says the *Illustrated London News*, to which we are indebted for the illustration and description, may be relied upon to do its deadly work, if it strikes; but it cannot be relied upon to strike, when sent long distances. It is subject to the attack of machine guns, and may be turned from its course by currents of water; while naval commanders have learnt not to lay their ships broadside to a point from which it may come, but to keep stem on, so that, at sight of the line of air bubbles which mark the torpedo's approach, a turn of the wheel will send it swishing off through the water. In fact, the torpedo can be of little use, unless brought by an unseen agency within actual striking distance of the vessel to be attacked.

So Mr. Andrew Campbell bethought himself how to construct a boat, of any dimensions, which could be readily submerged or floated in a safe and simple manner, leaving nothing to chance, and not depending on the power used for propulsion—a boat practically indestructible, efficient in any climate, and ready at any moment. How to do this was the problem. The notion that it could be done by simply increasing or decreasing the weight had failed; so had that of propelling the boat down nose foremost, for as soon as the machinery stopped, she found an even keel, and floated to the surface. Nor did Mr. Campbell think finality and absolute success had been reached by that better method adopted by Mr. Nordenfeldt, by which the boat is forced down by means of propellers or screws working horizontally at the side of the boat; for the capital fault still remains that submersion is dependent upon the machinery. The subtle is often explained by the simple, and it occurred to Mr. Campbell to study nature a little. Fishes and other animals living in water rise and sink without using their fins or any method of propulsion; it is done simply by contraction or expansion.

Then the question came, Is it possible to give this same expansion and contraction to such a rigid structure as a boat? The idea occurred, and was carried out, of placing in the hull of a water-tight vessel a series of metal cylinders, into which are fitted properly constructed rams, or drums, which can be protruded or withdrawn by a simple process, governed and worked by the crew of the vessel, by means similar to those used in steering an ordinary ship. The speed of rising or falling is easily and perfectly regulated; an even keel is always maintained, and perfect safety is assured. A torpedo may not simply be taken within striking distance, but may be attached and fired from a point of safety. The inventor claims that he has produced a boat which is perfectly under control; which can be kept at any given depth; which can be raised or sunk rapidly or slowly; and can be propelled at ten knots an hour, or floated, or submerged, and may be kept for hours or days in any position without using a fraction of the stored propelling power.

The Nautilus is a cigar-shaped vessel, 60 feet long and 8 feet in diameter amidships, built of Siemens-Martin steel three-eighths of an inch thick. She is propelled noiselessly by twin screws, worked by electric engines supplied from storage batteries of large capacity. For safety she is divided into four compartments, all the projectors and machinery being contained in one of these, so as to render them under easy control. Besides the projectors, she is fitted with water ballast as well as horizontal rudders; and, in case of an absolute breakdown, such as might be caused by a collision or a similar accident, a turn of a bolt will enable the crew to release a heavy weight, and so raise her to the surface. Thus everything is believed to have been done to insure absolute safety to all lives within her.

The inventor is so satisfied with the numerous trials of the vessel, which have taken place in the presence of many experts of the British and foreign governments, that it is proposed immediately to lay down several vessels of from 130 ft. to 150 ft. length, and of proportionate beam. Vessels of this size would be able to keep at sea for several days, and to contain permanent accommodation for officers and crew. Air, under pressure, is stored on board the Nautilus to an amount sufficient for three days' supply, and electric glow lamps supply light when the boat is submerged.

When lying on the surface of the water, only about ten inches of the central upper portion of the boat is visible above water line, and this is surmounted by a steel conning tower about 12 in. high and 15 in. diameter, and pierced with four sight holes. Entrance and exit are obtained by means of a manhole on the deck, which is secured by a water tight joint, and there is room for six persons in the central portion of the boat.

THE Page Belting Co., of Concord, N. H., has issued a pamphlet on the kinds and grades of belting to use for different kinds of work, which is calculated to be of much practical advantage to those dealing in or putting up belts to run machinery. It has formulæ to aid in determining the belting required to transmit a given amount of power, suggestions as to the proper way of putting up shafts and pulleys, and other valuable and interesting information.

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NEW YORK, SATURDAY, MARCH 26, 1887.

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THE DEFENSE OF NEW YORK HARBOR WITHIN THIRTY DAYS.

We recently suggested a problem for solution—the defense of New York Harbor, and destruction of a fleet attacking it, all operations to be comprised within thirty days. A number of communications have been received in reference to this subject, but very few of the writers have fully appreciated the conditions. The thirty day limit has been generally overlooked.

One writer describes a gunboat with turrets, protected by rollers, intended to deflect the balls. Another proposes submarine boats. Various more or less elaborate plans for establishing fortifications are suggested. Some plans sufficiently novel and ingenious may be especially noted. The utilization of the oil stored in large quantity about our city is proposed. Pipes are to be laid under the waters of the harbor and bay, and are to be provided with open jets. On the approach of a hostile fleet, oil is to be forced out through the proper lines of pipe, so as to confront or surround the invader with floating oil. By fire boats or projectiles, the oil is to be ignited. A sea of fire is thus produced, through which it may certainly be doubted if a fleet could penetrate. As a variation on this plan, the substitution for the oil in such a system of pipes of gas, natural or manufactured, is described. The air surrounding the vessels could be charged with enough gas to form an explosive mixture, which would ignite from the boiler fires of the ships themselves. The gas also would overcome and render insensible the crews, if it attained such proportions in the atmosphere. The barges and other such vessels, some writers suggest, should be loaded with stone and sunk on each side of the channel, so as to narrow it. The channel thus narrowed could be filled with torpedoes. A fleet entering the harbor would neeessarily come directly over them, and could then be blown up. A circular floating battery rotated by the tangential discharge of water, and carrying combined wood and steel turrets, is another suggestion.

But as will be seen from this *resume*, the full problem not been grappled with. The port of New York was to be assumed in its present condition. Within thirty days the defense was to be organized, only the material available on such short notice being employed. This includes the fleet of harbor and river vessels of every type, the scows and floats of the larger sizes, tug boats, and even canal barges. Extemporized torpedo systems might be provided. Neither should it be forgotten that we are but a few hours from Pittsburg, with its supplies of iron and steel, and that timber in endless quantity could be sent down the Hudson River. With these existing resources, we believe much could be done within the stipulated time. What we wished to elicit was an organized plan for utilizing these ready resources only.

Now, owing to the action of Congress in providing large appropriations, it seems probable that the creation of a navy is but a question of a few years for us. The action of this Congress will doubtless influence its successor, and soon the United States may be a rival of England in the production of ironclad ships of war and torpedo boats.

SEA TELEPHONY.

A report from Fort Myers, Florida, where Mr. Edison is sojourning, says that he is working on his sea telephone. The inventor says that already he can transmit sound between two vessels from three to four miles distant, the one from the other, and he seems confident, now the principle is established, that he will be able to increase the distance between his stations as the apparatus becomes more perfect.

The Florida waters are peculiarly favorable for experiments of this nature, because of the absence of steamers upon them or other disturbing sounds on the adjacent shores—resembling in their quiet repose the waters of the open sea, where the invention he is striving to perfect will find its most important application.

Up to the present time, Mr. Edison has not succeeded in transmitting articulate speech through his sea telephone, nor is this essential to the success of the system. By means of submarine explosions, he is enabled to form a series of short and long sounds in sequence, and by these, as in the Morse system of telegraphy, words and sentences can readily be transmitted.

In the original experiments in this direction, made by Prof. Trowbridge, and from which these have sprung, two vessels, each furnished with an electric generator and a steam, engine, were anchored a mile or two apart in quiet waters; wires charged with the current were hung over their sides into the water, the upper ends being connected with the telephonic transmitter and receptor. It was sought to send articulate speech between them, and when the two were quite near together, this, it is said, was readily accomplished. Later, however, this seems to have been regarded as impracticable, and the system, now experimented upon by Mr. Edison, of transmitting short and long sounds was adopted, and, up to a certain point, gave no little promise.

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The distance which separates the purely scientific from the practical success is so wide, however, and the way is so beset with obstacles, that it is no easy matter to find, or if found to keep, the right road, and so it was that these first experiments, valuable as they were, soon ended, and it remains for the practical man, the experimenter rather than the student, to take up the problem and push it on to a solution. Edison is peculiarly fitted and equipped for this werk. When in good health, he is a close and constant observer, tireless and original. If he succeeds in finding a practical and reliable means of transmitting any kind of intelligible signal through the water between two vessels several miles apart, a principal cause of disaster on the ocean will have been removed. Though many ingenious and admirable contrivances have been thought out of late years to lessen the dangers of ocean travel, nothing has been done to prevent collisions in thick or foggy weather, which may fairly be said to be the most menacing of all.

It has before been explained in these columns that the present system of whistle and horn signaling is reliable only while favorable conditions prevail, to wit, in calm weather. At other times, when two vessels approach one another, only that which is to leeward is likely to hear the warning whistle or horn; and when the wind is abeam or quartering, the direction of the warning signals is so indefinite as to give little or no indication of the point whence danger is to be expected.

Were the sea telephone perfected, however, collision in thick weather could readily be averted. Vessels would keep their telephone warning going, as well as their whistles, and, while the latter only sounded a general alarm, the telephone would give the exact compass course of the direction whence each ship was advancing, and this, too, in time to prevent a meeting.

THE SCIENTIFIC AMERICAN—ARCHITECTS' AND BUILDERS' EDITION.

We call the special attention of our readers to the announcement, published on another page, of this interesting and valuable publication. It has now been issued for about a year and a half, has grown rapidly in popularity, having attained the largest circulation of any periodical of the kind. While in general style of typography it bears a resemblance to the elegance of the SCIENTIFIC AMERICAN, still its contents and subject matter are almost wholly different, and it reaches an entirely distinct and separate circle of readers. It is, in brief, a comprehensive *Magazine of Architecture*, wherein will be found, illustrated in the most beautiful manner, the best examples of buildings and the various subjects thereto pertaining. It is especially full and abundant in its drawings of dwelling houses of moderate cost. In every part of the country are families who look forward to the time when they may possess a home of their own, with all its enjoyments of tranquillity and happiness.

In the selection of plans, and in the supplying of information relative to buildings and materials, this beautiful periodical of ours will be found most useful and valuable.

The New Health Board President.

Mayor Hewitt appointed, a few days ago, Mr. James C. Bayles president of the Board of Health for this city.

The selection of Mr. Bayles for the office is considered by most persons to be a good one; but when it came to the knowledge of the politicians around the City Hall that the appointee was a non-partisan engineer and a Knight of Labor, it created considerable excitement among them—not that this class of politicians are so adverse to the Knights of Labor as their action would imply; but the fact was, they were disappointed that the mayor had the independence to go outside of their circle and appoint a practical engineer instead of a professional politician.

But Mayor Hewitt was equal to the occasion, and when his motive for making the appointment was questioned, made the following manly reply:

"I did not know when I made the appointment that Mr. Bayles was a Knight of Labor, but if I had, that fact alone would not have made any difference to me. I should have appointed him anyway, because I believed him to be a competent man for the position. Had I known that he was a member of the order, I might have asked him if he approved of the methods of the Knights, and the manner in which they acted during the last strike. If he had said he did approve of them, I should certainly not have appointed him as president of the Board of Health. But I believe that Mr. Bayles is opposed to such actions, and would not for a moment tolerate them.

"I am not opposed to trade organizations when they do not violate individual rights. What I am opposed to is their dictation and their assumption of the right to say who shall and who shall not work. Like Cardinal Gibbons, I find the paper declarations of the Knights of Labor to be beautiful. I am opposed to them when they violate these paper declarations. Mr. Bayles I believe to be a sensible man, and I think he will fill the place he now holds creditably. He has a perfect right to belong to any organization he sees fit. What I'm fighting for is liberty of action. If a man wants to join the Knights of Labor, let him do so, but don't let them try to compel other men to join the organization who do not want to have anything to do with it."

Asses' Milk Diet.

In France, where the authorities do so much for the protection of the people at large, by their watchful care to prevent accidents to the work people, and their extensive provision for the protection and maintenance of homeless children and those of miserable parentage, the administration of the hospitals and other public institutions are constantly experimenting in the treatment of their inmates. Quite recently the administration of the Assistance Publique, in Paris, has decided to employ asses' milk at the Hopital des Enfants Assistes. For a while the administration substituted goats' milk for human milk; but the infants did not thrive upon it. The administration has now provided ten asses, which are kept in the stables of the hospital with their young. Each ass is capable of nourishing three children besides its own young for the first three months, and two children for the two following months. After this period it is capable of nourishing one child until the ninth month.

The superior soothing and nourishing qualities of asses' milk over that of the cow, or goats' milk, has been long known, and many persons who have suffered with dyspepsia, and after trying numberless remedies and been abroad for treatment, have returned with health restored, the result attributable to the use of asses' milk taken warm from the udder.

The writer has in mind a lady who had suffered an aggravating form of dyspepsia, until her digestive organs had become so impaired that the simplest diet could not be taken without producing great distress. She had been under the care of physicians of nearly every school of practice in this city, and finally she was taken to a neighboring city and placed under the care of a doctor distinguished for his successful treatment of dyspepsia. His system consisted principally in secluding his patients from their families and friends and requiring them to remain in bed for several weeks. After some three months' perfect rest (for even the reading of books or newspapers was denied her), and the daily application of electricity by an assistant of the distinguished practitioner, and the equally frequent application of oil and rubbing-in process by a faithful female attendant, the lady had become so weak it was with difficulty she could get out of her bed. Her food was specially prepared at the chemist's, under the direction of the doctor, but every variety she tried distressed her, and finally, as soon as a little strength had been restored, she returned to her home and resumed the milk diet, which, from long experience, she had found to produce less distress than any other. The rest cure, as it is called, was, in this lady's case, a failure, and what should be the next experiment to try was a question of serious discussion for some time, and, with many misgivings as to the result, it was decided to try a season abroad, and it was in France the diet of asses' milk was recommended and tried with the most beneficial results.

From the observation of the writer, we believe that suffering dyspeptics and delicate children may be relieved of a great deal of misery and precious lives saved by the more universal use of asses' milk, the virtues of which seem to be better understood on the Continent than by physicians in this country.

Vulcabeston.

This is the name of a new article, intended to combine all the valuable qualities of asbestos and India rubber, of which, as its name indicates, it is mainly composed, although other vulcanizable materials enter into its composition. It forms a substance of the toughness of horn, although it can be made of any degree of flexibility; it is a non-conductor of electricity, and stands the severest test of acids, steam, gases, etc. From its quality of permanently resisting heat, which has been so long known as the characteristic feature of asbestos, it has been adopted by the United States Government for use around steam engines.

One of the most important uses of the new article is as a moulded piston rod packing ring, made to fit any sized rod or stuffing box, and to be sprung in place with a slight pressure, one or more rings being used as desired, and forming a perfectly tight steam joint. These rings do not wear the rod as do metal rings, and they are self-lubricating. The first set made of these rings has been in use over eleven months, in a Hartford, Conn., manufactory, on an engine run at 280 strokes per minute, and is still in perfect order, and said to be in as good condition as when first put in.

Vulcanized asbestos piston rod packing in the form of flexible rope, of all sizes, will not shrink or blow out, and is especially adapted for use on locomotives and ocean steamers, and in other places where loss of time in repacking is of the greatest consequence, and when the use of ordinary steam packings would, consequently, be entirely inadmissible. In consequence of its great strength and durability, it can be used wherever metallic packings have heretofore been necessary.

The new vulcabeston is made into sheet packing, hard, medium, and soft, in sheets or rolls, in all sizes of round and oval gaskets, and in hard and medium moulded piston rod packing rings of all the regular sizes, any special forms being readily made to order. The vulcabeston can, if desired, be made of any color, and is thus well fitted for a variety of ornamental work and other special uses.

Vulcabeston is manufactured exclusively by the Johns-Pratt Company, of Hartford, Conn., Mr. Johns, of the widely known H. W. Johns Manufacturing Co., of New York, and whose name has for more than a quarter of a century been prominently identified with all manufactures of asbestos materials, being at the head of the business.

Proving the Soundness of an Eye.

In a large factory in which were employed several hundred persons, one of the workmen, in wielding his hammer, carelessly allowed it to slip from his hand. It flew half way across the room, and struck a fellow workman in the left eye. The man averred that his eye was blinded by the blow, although a careful examination failed to reveal an injury, there being not a scratch visible. He brought a suit in the courts for compensation for the loss of half of his eyesight, and refused all offers of compromise. Under the law, the owner of the factory was responsible for an injury resulting from an accident of this kind; and although he believed the man was shamming, and that the whole case was an attempt at swindling, he had about made up his mind that he would be compelled to pay the claim. The day of the trial arrived, and in open court an eminent oculist retained by the defense examined the alleged injured member, and gave his opinion that it was as good as the right eye. Upon the plaintiff's loud protest of his inability to see with his left eye, the oculist proved him a perjurer, and satisfied the court and jury of the falsity of his claim. And how do you suppose he did it? Why, simply by knowing that the colors green and red combined make black. He prepared a black card on which a few words were written with green ink. Then the plaintiff was ordered to put on a pair of spectacles with two different glasses, the one for the right eye being red and the one for the left eye consisting of ordinary glass. Then the card was handed him, and he was ordered to read the writing on it. This he did without hesitation, and the cheat was at once exposed. The sound right eye, fitted with the red glass, was unable to distinguish the green writing on the black surface of the card, while the left eye, which he pretended was sightless, was the one with which the reading had to be done.—*Pottery Gazette.*

Oxygen in Vital Phenomena.

Some interesting information is given by Dr. B. W. Richardson respecting the influence, under varying conditions, of oxygen in vital phenomena (*Asclepiad*). It was obtained by inclosing mice in glass chambers containing atmospheres in which the proportion of oxygen varied with the experiment, and observing the time that lapsed before the animals became narcotized at different temperatures. It was found that, at a temperature of 55° F., when oxygen and nitrogen were present in the proportion of 1 and 4 (*i. e.*, common air), the animal became narcotized, and died asleep, in one hour and fifty minutes. In two parts of oxygen and three of nitrogen, as well as in three of oxygen and two of nitrogen, the animal remained free from narcotism thirty minutes longer, but eventually became rapidly narcotized, and died within two minutes of the same time. But with four volumes of oxygen and one of nitrogen, narcotism did not occur for two hours, and then lasted six hours before death took place, while with pure oxygen narcotism was also deferred for two hours, but only lasted four hours.

When an animal was placed in a vessel five times as large as those previously used, containing common air, so that the quantity of oxygen present was equal to the smaller atmosphere of pure oxygen, narcotism did not occur until after nine hours, and death after eleven and a half hours, which indicates the vital value of nitrogen as a diluting agent. In the case of the pure oxygen the larger proportion of the gas remained unchanged, and five similar experiments were made before sufficient carbonic dioxide was formed to cause asphyxia. When the temperature was lowered to 20° F., the effect was to reduce the vital combining power to such an extent that oxygen became practically an anæsthetic gas; in pure oxygen the animal was narcotized in a few minutes and died in half an hour, while in common air the animal remained longer awake, but died in forty-five minutes. When temperature was raised to 70° and 90° F., pure oxygen sustained life longer than common air in equal volume, but at 125° F. coma and death took place in fifteen minutes.

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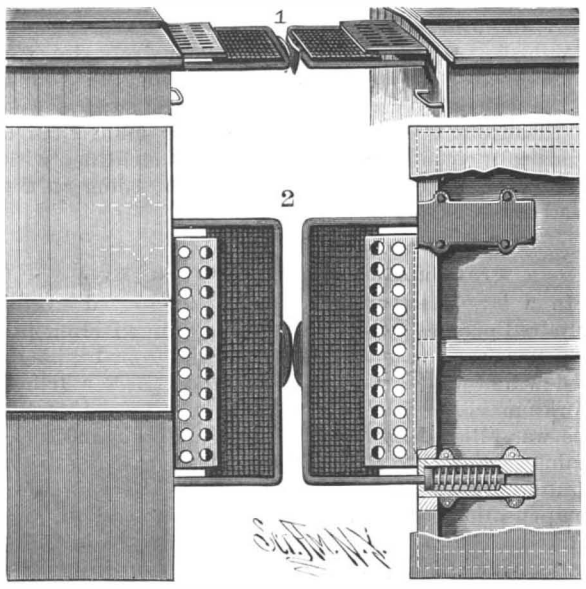
SAFETY PLATFORM FOR CARS.

The object of this invention is to provide for freight and other cars a platform at the ends near the top, for forming a continuous walk for the brakemen, in order that they may pass from car to car without danger of falling between. The support of the platform consists of an iron bar bent twice at right angles in a horizontal plane, and the ends of which enter sockets secured in the top of the end of the car, as shown in the sectional plan view, Fig. 2. Within the



CALDWELL & QUATERMASS' SAFETY PLATFORM FOR CARS.

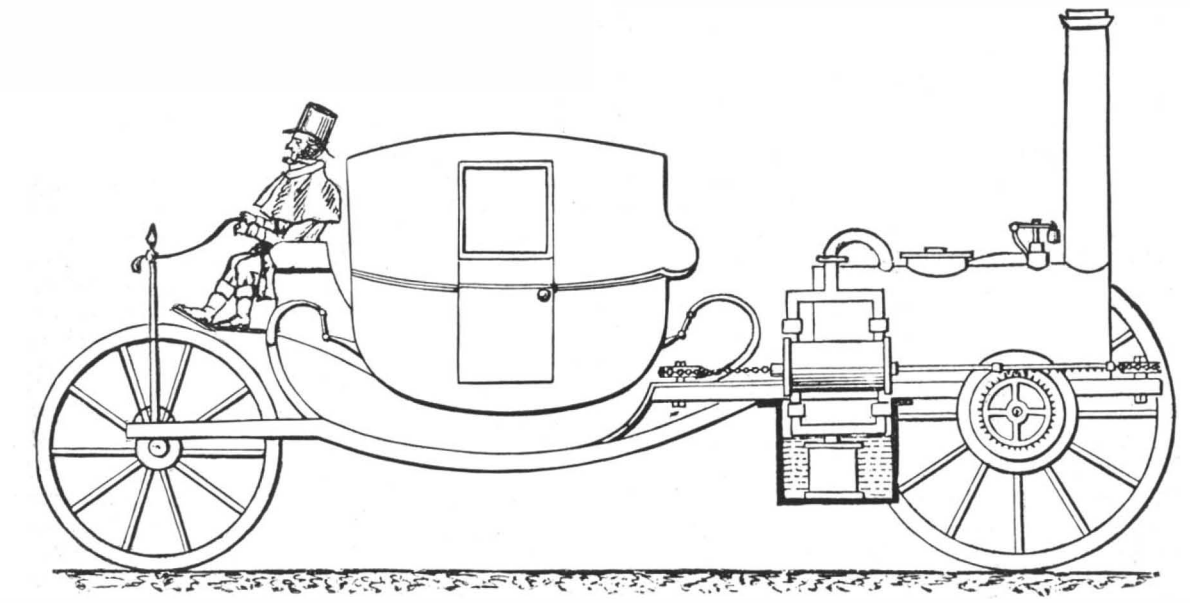
socket, upon each end of the bar, is a spring so arranged as to press the bar outward. Upon the support thus made is secured a perforated grating, forming the body of the movable platform. Secured to the end of the bar is a perforated plate, which overlaps the platform (as shown in the upper view), so that the latter may be moved inwardly underneath the plate. To the outer edge of the frame is secured a buffer, designed to contact with a similar buffer carried by a like platform upon the adjacent car, so that when the two cars meet and are coupled, the frames and their gratings will be pushed inward against the pressure of the springs. Arranged in this way, the platforms will adjust themselves to the space between the cars, and will always close the space, so as to furnish a continuous walk for the brakeman. The platform may be made narrow, as illustrated, or it and the plate may be provided with hinged extensions, which will normally rest so as to form a walk the full width of the car; but when it is desired to climb to the top of the car, the extensions can be folded over on to the parts to which they are hinged. It is evident that the frame can be bent, to raise or lower it, so as to suit cars of different heights.

This invention has been patented by Messrs. S. H. Caldwell and R. Quatermass, of Moline, Kansas.

HERR SCHILLER, a well known German architect, reports some facts which are of interest, as indicating the radius of the circle of protection of good lightning rods. On June 17 last, at the village of Mottingen, lightning struck a pear tree 33 ft. high. On one side, 115 ft. away, was a schoolhouse, with a rod 46 ft. high. On the other side was a church, 328 ft. away, and having a lightning rod reaching up 154 ft. Both rods are well placed, and had worked well when tested, and the level of the foot of the tree is about the same as that of the two buildings. It is evident, then, if the facts have been accurately reported, that the radius of the circle of protection is not more than twice the height of the rod.

SYMINGTON'S EARLY ROAD LOCOMOTIVES.

William Symington, the engineer, who is generally acknowledged to be the inventor of the first successful steamboat, was born at Leadhills, in Scotland, in 1763. His father was a practical mechanic, who superintended the engines and machinery of the Lead Mining Company at Warlockhead, where one of Boulton & Watt's pumping engines was at work. Young Symington, like Murdock, was placed under his father's tuition in the North Country workshop, and, like Murdock also, he gave early proof of his ingenuity. He appears at the age of twenty-one to have conceived the idea of applying the steam engine to the propulsion of carriages. His father and he worked together to carry the idea into effect, and by the year 1786 they succeeded in completing a working model of a road locomotive. So efficiently did the model work, that those who saw the machine expressed such favorable opinions respecting it, that the difficult problem of moving carriages on the highway by steam power appeared to be within measurable distance of being solved, and Symington was warmly urged to carry his experiments to a practical issue. Mr. Meason, the manager of the lead mine, "was so pleased with the model, the merit of which principally belonged to young Symington, that he sent him into Edinburgh, for the purpose of exhibiting it before the professors of the university and other scientific gentlemen of the city, in the hope that it might lead in some way to his future advancement in life." Moreover, Mr. Meason, who proved to be his patron and friend, allowed the model to be exhibited at his own house, and invited many persons of distinction to inspect it, and he liberally offered to defray any expenses which might be incurred in carrying the invention out in practice. The state of the roads, and the difficulty which at that time existed of procuring water and fuel, afforded sufficient reasons to induce Symington to conscientiously abandon the scheme, which, through these causes, he believed, would only have produced disappointment to his kind advisers. By referring to the illustration below of Symington's locomotive, it will be seen that it



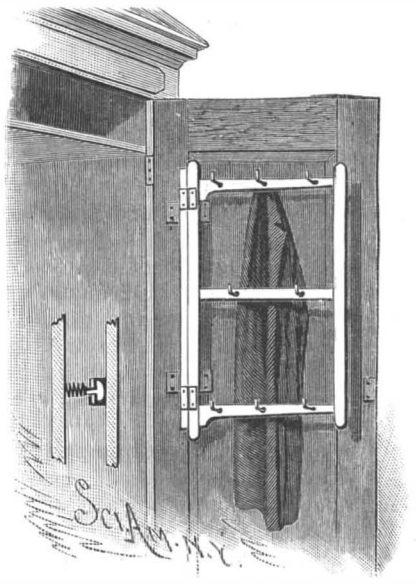
SYMINGTON'S ROAD LOCOMOTIVE, 1786.

consisted of a carriage with locomotive behind, supported on four wheels, the front wheels being arranged with steering gear. A cylindrical boiler was used for generating steam, which communicated by a steam pipe with the two horizontal cylinders, one on each side of the fire box of the boiler. When steam was turned into the cylinder, the piston made an outward stroke; a vacuum was then formed, the steam being condensed in a cold water tank placed beneath the cylinders, and the piston was forced back by the pressure of the atmosphere. The piston rods communicated their motion to the driving axle and wheels through rack rods, which worked toothed wheels placed on the hind axle on both sides of the engine, and the alternate action of the rack rods upon the tooth and ratchet wheels with which the drums were provided produced the rotary motion. Symington stated that a material advantage obtained by the mode here employed of applying the power of the engine was that it always acted at right angles to the axle of the carriage. The boiler was fitted with a lever and weight safety valve, and as a whole the arrangement of the engine and carriage displays much ingenuity; but we fear that the rack rods would prove unsatisfactory, while the traveling speed must have been very slow indeed. Symington's road locomotive was allowed to slumber, never to have an awakening, while the inventor turned his attention to the propulsion of vessels by steam.—*Industries.*

The Marine Engineer, London, says that F. Schichau, extensive shipbuilders, at Elbing, Prussia, have built and have now on the stocks one hundred and fourteen torpedo boats.

CLOTHES RACK.

This clothes rack is secured to the inner face of the door of an ordinary wardrobe, and consists of a vertical supporting strip, the rear edge of which is recessed and held to blocks attached to the door by screws. To the strip is hinged a rectangular frame consisting of vertical and horizontal pieces, the latter being provided with hooks on each side. Attached to the inner face of the outer strip by an elastic band or spring is a button, shown in the small view, arranged to engage with a socket secured to the door and formed with a centrally slotted arm. The clothes being hung upon the hooks, the frame may be held in a position parallel with the door by bringing the button into engagement with the socket. The frame may be swung open by releasing the button. When the device is to be used as an independent piece of furniture, the blocks are screwed to any available support. In this case a curtain should be arranged above the rack, in order that all dust may be kept from the clothes.



This invention has been patented by Mr. James S. Marsh, of Portsmouth, Ohio.

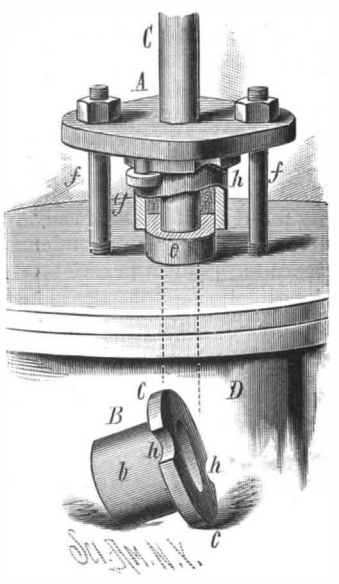
Quality, Not Quantity.

In reply to a letter of inquiry addressed from the *Industrial World* to the Washburn & Moen Manufacturing Company, of Worcester, Mass., they send the following, which embraces so much good advice, applicable to all lines of industrial pursuits, that we take pleasure in transferring it to our columns:

"If manufacturers in all lines of goods would have faith enough in themselves, and in the markets of this country, which are unequaled, and would pay more attention to the quality of their goods and the economies possible in manufacturing, and less to the mere work of getting rid of their goods without much regard to price, a very much healthier condition of things would obtain throughout the whole country. Every manufacturer of a staple line of goods in a fairly good location is insured a fair profit from his business by the extent of the American market, and nothing but unreasoning and precipitate competition can effectually neutralize this wonderful and perpetual condition of things, *i. e.*, the extent and reliability of the American market for any and all staple goods."

IMPROVED STUFFING BOX.

The annexed engraving illustrates a stuffing box which is the invention of Mr. C. P. Wetherill, of Woodville, Miss. The gland of the stuffing box is composed of two separate and distinct parts, A B. The part, A, is an outer flanged plate, and the other part is a ring, *b*, provided at one end with a flange, *c*, the outer surface of which bears against the inner face of the plate, A. The part, B, is of sufficient interior capacity to contain the packing, which, surrounding the piston rod, C, is compressed against a neck, *e*, upon the cylinder head when the gland is forcibly held down to its place by the stud bolts, *f*, screwed into the cylinder head. The collar portion, *b*, is held against the plate, A, by clips or headed bolts, *g*, projecting from the back of the plate and entered, when the collar is properly turned, through recesses, *h*, in the flange, *c*, of the collar, so that on turning the collar back again to its normal position, with the recesses out of line with the bolts, the heads of the bolts will engage with the inner face of the flange, and lock the parts, A and B, together. This construction of the stuffing box greatly facilitates the insertion and removal of packing when required, especially in contracted and awkward places.



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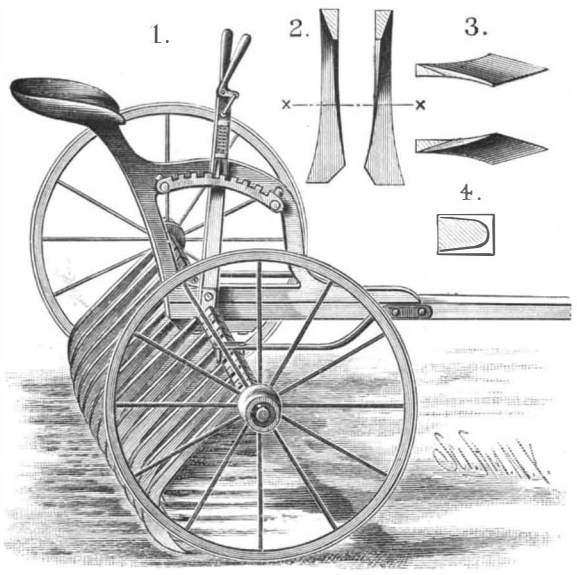
ADJUSTABLE HARROW.

Fig. 1 is a perspective view, Fig. 2 a view of a portion of the central teeth of the harrow, Fig. 3 a sectional view on the line *x*-*x*, and Fig. 4 is an enlarged sectional view of the axle of an adjustable harrow, the invention of Mr. William T. Parker, of Eureka, Ind. The axle is formed with recesses to receive the teeth, and with round portions to receive the rear ends of the

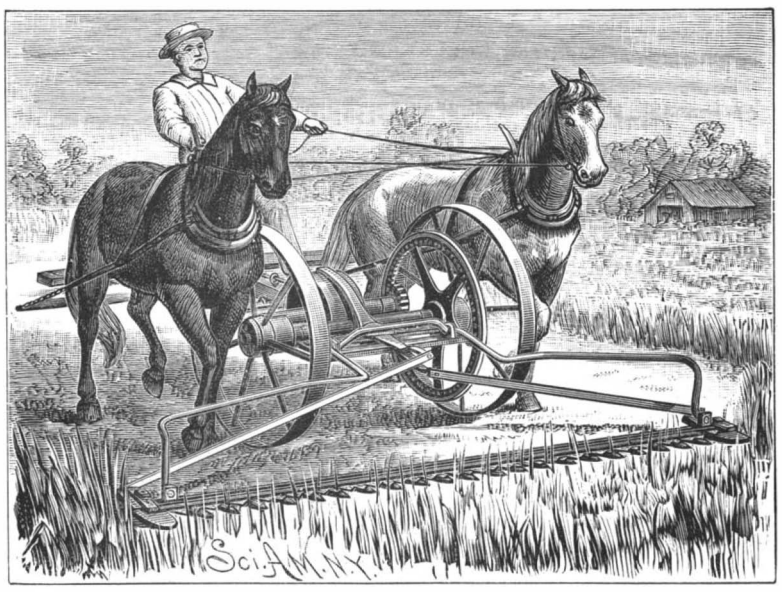


PARKER'S ADJUSTABLE HARROW.

tongue and its braces. The seat frame or standard is bolted to the upper face of the pole. To one side of the standard is secured a segmental toothed rack, and to the axle is rigidly connected one end of an operating lever, whose upper end is provided with a thumb lever carrying a broad catch tooth which is normally held in engagement with the rack teeth by a spring. The harrow teeth consist of bars, the upper ends of which are bent so as to fit the axle closely, and if desired, each tooth may be held to the axle by a set screw. From the axle the teeth extend downward, and finally forward, their lower ends being flattened, and flared off to the right or left, the teeth upon the right of the pole flaring to the right, while the others flare to the left. In this harrow the teeth may be thrown downward by moving the lever backward, and may be held in that position by locking the lever. This harrow may be used either upon plowed or unbroken ground, and may be adjusted to make almost any required depth of cut.

IMPROVED MOWER.

The mower herewith illustrated is extremely simple in construction, is not liable to get out of order, and is so designed that it requires less power to operate it

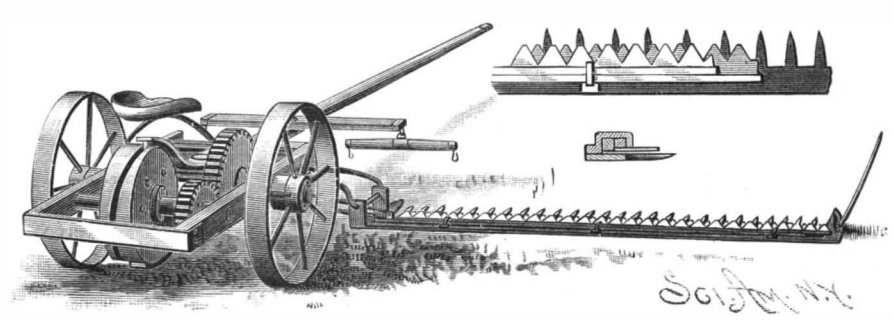


NIETH & THOMAS' IMPROVED MOWER.

than the ordinary mower. The drive wheels are rigidly connected with the axle, to which is attached a large gear wheel, that meshes with a smaller wheel on a shaft journaled in bearings in the rear parts of the side bars of the frame. To this shaft is secured a cam wheel, in the face of which is formed a zigzag or cam groove, to receive, at diametrically opposite points, pins attached to the rear ends of levers. The groove is made dovetailed to receive balls pivoted on the pins, to lessen the friction, and to keep the rear ends of the levers in place against the upper and lower sides of the cam wheel. The levers are curved toward each other at the forward side of the cam wheel, and are pivoted at their middle parts to the central cross bar of the frame. The forward parts of the levers are parallel, and to their forward ends are pivoted the inner ends of two pitmen whose outer ends—in the construction shown in the lower engraving—are pivoted to the inner ends of two cutter bars, which are placed side by side upon the finger bar, where they are kept in place by keepers. The arrangement of the finger bar and cutter bars is shown in the small sectional and plan views in the lower engraving. The cutters attached to the lower side of the rear cutter bar slide upon the finger bar, while the cutters of the forward cutter bar slide upon the cutters of the rear bar. The rear cutters are made longer than the others, so that the forward ends of both sets are in the same vertical plane. The cam groove is so formed that the levers, and consequently the cutter bars, always move in opposite directions, and a shearing cut is produced. As the inner shoe of the finger bar is hinged to a suitable frame, the bar may be turned up into a vertical position for convenience in passing from place to place. This also allows the finger bar to adjust itself to the surface of the ground.

The mower illustrated in the upper engraving embodies the same principles as that just described, but, as will be seen from the cut, the general arrangement of the parts is very different.

This invention has been patented by Messrs. J. E. Nieth and C. L. Thomas, of Independence, Iowa.

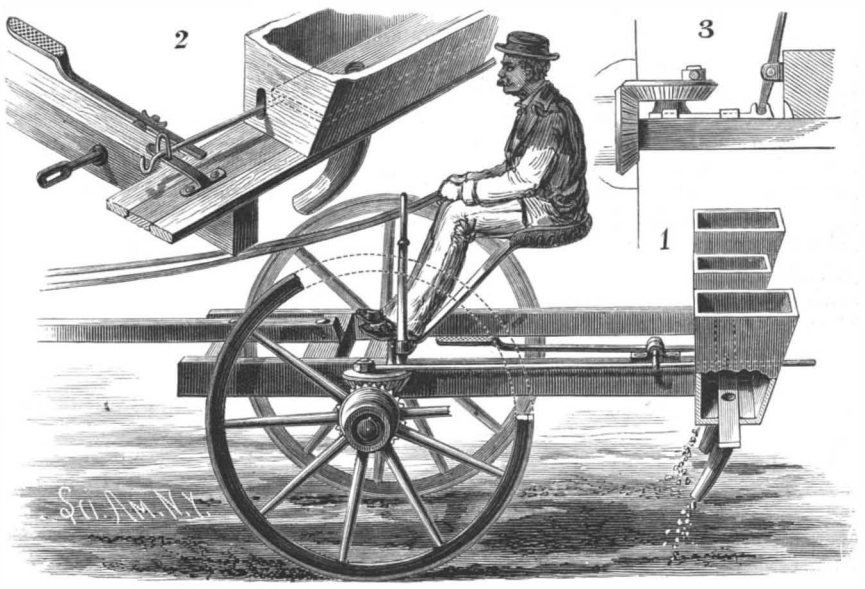


NIETH & THOMAS' IMPROVED MOWER.

IMPROVED CORN PLANTER.

Secured to the rear part of the main frame are two hoppers, between which is a receptacle for lime or other powder for marking purposes. A grain-delivering slide of the customary construction extends underneath, and operates to liberate modicums of grain from both hoppers. The lime receptacle has a slide which, when connected with the main slide, moves synchronously with the latter, and delivers the marking powder into a flexible spout, the mouth of which may be arranged so as to deliver the masses of powder at any desired locality upon the ground in relation to the deposits of grain. Attached to the hub of one of the main wheels is a beveled gear (Fig. 3) that meshes with a somewhat larger gear revolving in a horizontal plane about a stud extending from a slide which is confined in ways upon the frame over the axle. By means of a suitably arranged lever, the large wheel may be shifted to bring it into or out of engagement with the other. Secured to one side of the main frame is an eye bolt, which serves as a fulcrum for a lever attached at one end to a wrist pin on the horizontal gear wheel and at the other end to a staple on the grain slide, so that the revolution of the wheel will impart an oscillating motion to the slide. In the normal condition of the parts, the operation of the grain slide is not accompanied by any movement of the marked slide, and consequently no powder is deposited; but by simply moving a lever (Fig. 2), the treadle of which is within convenient reach of the operator's foot, the two slides may be made to move with each other. When it is desired to move the machine without depositing either grain or marking powder, it is only necessary for the operator, by means of a suitable lever, to temporarily throw the horizontal gear wheel out of engagement with the other, when the implement may be drawn from place to place like an ordinary car.

All further particulars concerning this invention can be obtained by addressing the patentee, Mr. Henry Kendall, P. O. box 1010, Xenia, Ohio.



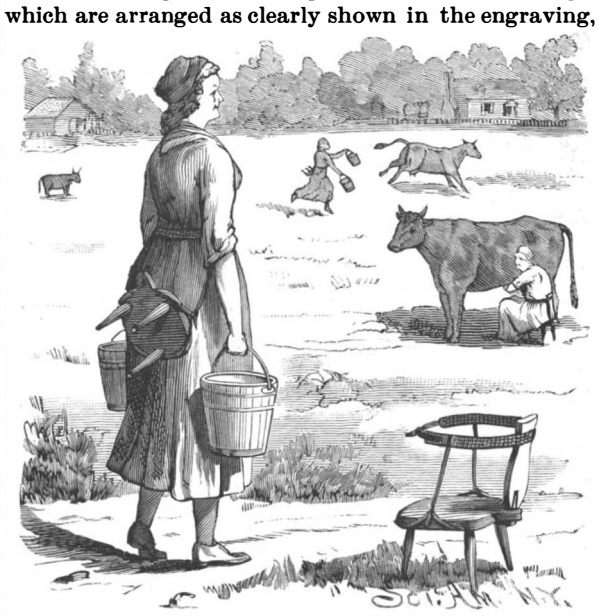
KENDALL'S IMPROVED CORN PLANTER.

Lime Juice.

A large quantity of lime juice has been exported from Trinidad in recent years. The simple juice finds a market in America, and the condensed juice in England. A tree yields on an average about ten gallons of juice. The limes are allowed to drop off, and then passed first through the cutter, which rips them open, and next through rollers and a press to separate the juice. These cutters, rollers, and press are constructed in a very primitive way, and admit of great improvement. The juice is then exported either as it is, or condensed by boiling. A barrel of limes yields seven gallons of juice. The cost of producing lime juice, including packages, should not exceed 6*d.* per gallon. The essential oil of limes is extracted from the rind before crushing by grating on rasps with the hands. The oil thus extracted is called hand made oil. A hundred gallons of juice will yield by distillation about three quarts of the essential oil.

MILKING STOOL.

This milking stool is held to the wearer by a waist strap, and hangs down behind out of the way, leaving both hands free to carry two pails. As soon as the wearer is ready to sit down to milk, by merely leaning slightly forward the stool swings directly beneath the person, so that it is not necessary to touch it with the hand. The back or waist board is not designed as a support for the back, but as a means of attachment to the waist strap, and to cause the stool to swing under the wearer as the latter sits down. The lower end of this board is swiveled to the seat, so that the wearer can walk into a narrow stall, and sit down sideways to the cow, when there is not room to turn and sit down facing the cow, in the first place, and then turn on the stool so as to face the cow, the stool itself remaining in its first position. The side straps, which are arranged as clearly shown in the engraving,



COWAN'S MILKING STOOL.

may be lengthened or shortened as desired by the user.

This invention has been patented by Mr. A. B. Cowan, of Hall's Valley, Ohio.

A Problem for the Inventor.

A friend who has seen the ice palaces at Montreal and Minneapolis suggests that if some ingenious man would only invent an easy method of preventing ice from melting, what a handy and inexhaustible supply of fine building material we should have! Then every man might cut blocks from the frozen pond or river, and live in a palace.

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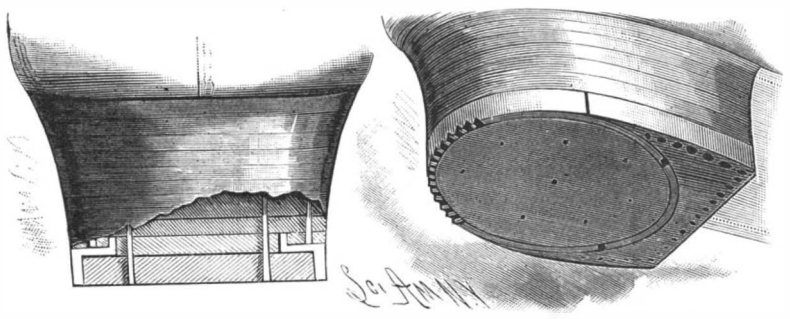
HEELS FOR BOOTS AND SHOES.

The object of this invention is to provide a comparatively inexpensive heel, so made and fitted with an adjustable metallic wear plate that uneven wear of the heel or sole of the boot will be prevented, and the durability of the foot wear will be materially increased. Fitted in a suitable recess in the body of the heel is an upwardly projecting flange, formed on an annular metal plate having a downwardly projecting flange, which at its outer face stands about flush with the round back portion of the heel, and also fits against the rear concavity of the front lift. Within the heel plate is fitted a leather lift, through which nails or screws are driven, to hold both the lift and plate securely to the heel, while the plate may be rotated by applying a knife or hook to any one of a series of notches made in its outer flange. In this flange is formed a series of spurs or teeth, shown in the right hand view, which may be brought to the outer side portion of the heel by turning the plate, to prevent the slipping of the boot on icy pavements. As the flange is exposed clear around the back of the heel, quick wear is prevented; and as one part wears a little, the plate may be turned, more or less, to present a new edge surface of its flange. Hence, the heel will always be kept comparatively true and flat, to prevent running over of the foot of the wearer at the counter of the boot, and insure an even wear of the sole, and thereby increase its durability. The method of securing the plate prevents rattling, and deadens very largely the sharp click, incident to contact with pavements, of metallic wear plates of this character.



GRAY'S HEELS FOR BOOTS AND SHOES.

This invention has been patented by Mr. John P. Gray, Simcoe, Ontario, Canada, who will furnish all further information.

NOTEBOOK HOLDER AND INDICATOR.

This simple device is for supporting a notebook or copy in position for convenient reading by a type writer or type setter, and for indicating the successive lines of copy, to facilitate correct reproduction. Across the bottom of the bed or platen is a flange to support the book or copy, the upper end of which is held by clips. At the opposite ends of the left hand side the bed has fixed lugs, in which is journaled a screw carrying a ratchet wheel at its lower end. The ratchet is engaged by a rack bar supported in suitable bearings fixed to the bed, and connected at one end to a spring which acts normally to draw the bar toward the right-hand edge of the bed, the teeth of the bar then slipping over those of the ratchet; but when the bar is moved in the opposite direction, by the operator grasping its knob or handle, the ratchet wheel and its screw are turned.

By means of a collar held by a set screw on the bar, it is possible to regulate the extent of movement of the rod, for turning the screw more or less to shift the line indicator a greater or less distance, as required by the space between the lines of copy. Held in the outer ends of the lugs, parallel with the screw, is a rod, on which the head piece of the indicator is fitted to slide and turn. The base of the head is formed with half threads, held in engagement with the screw by a properly arranged spring. The indicator may be released from the screw to allow it to be quickly shifted to proper position over the copy. Held to the center of the back of the bed is a hollow arm, in which slides a rod connected to an extension arm by a tongue and groove joint, allowing the bed to be swung in a horizontal plane to any required angle, thereby enabling the operator to use the copy to the best advantage. The distance of the copy from the type writer may be adjusted by shifting the rod in or out, and by turning the rod the copy may be held at any desired inclination. At the outer end of the curved extension arm is a clamp for holding the copy holder to the type writer. The hollow arm is so held to the bed as to permit of the edgewise adjustment of the latter.

After the copy holder has been adjusted to suit the convenience of the operator, the indicator is moved to the upper line or place of beginning the work. When the first line has been written, the rack rod is moved to turn the ratchet wheel and screw, which will draw the indicator downward to the next line of copy; and when the bar is released, the spring will draw it back to its first position, ready for another movement. When the page of copy has been written, the indicator is raised to admit another sheet, and then moved to the top again.

This invention has been patented by Mr. A. H. Merrill, of Sanford, Fla.

MERRILL'S NOTEBOOK HOLDER AND INDICATOR.

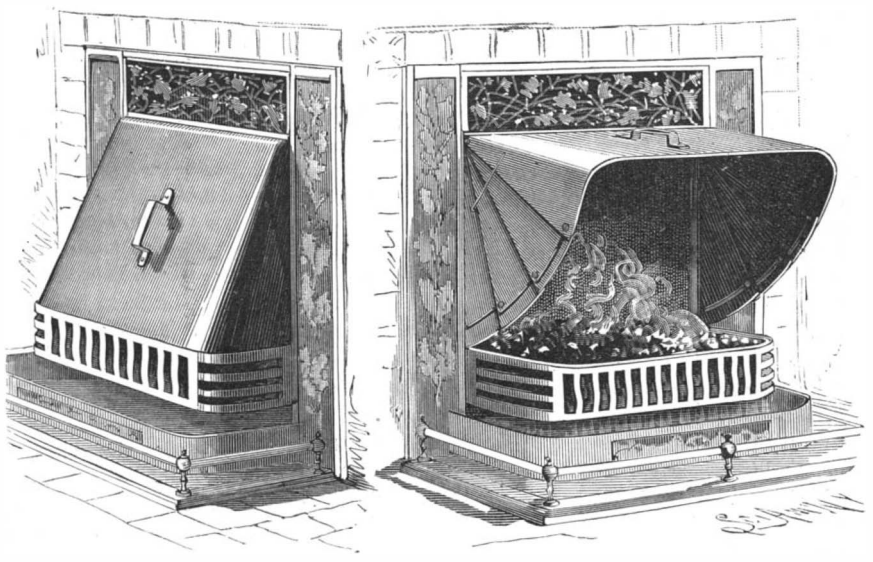
Edison may still Hear Beecher's Voice.

In the house of Thomas A. Edison, at Llewellyn Park, is a remarkable memento of Beecher. The inventor's phonograph for impressing on a soft metal sheet the utterances of the human voice, and then emitting it again by the turning of a crank, has never been put to any very valuable use, and Edison has only gained from it a few thousand dollars in royalties from exhibitors. But he utilized it to make a collection of famous voices. Since he became famous, his visitors have included hundreds of celebrities. Instead of asking them for their autographs or photographs, he has, in two or three hundred instances, requested them to speak a few sentences into a phonograph. He has kept the plates in a cabinet, and occasionally he runs some of them through the machine, which sends out the words exactly as uttered. Edison is probably the only man who can revive the silenced voice of the great preacher. —*Philadelphia Times.*

The instrument above referred to, the speaking phonograph, was fully described in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 115, as long ago as March 16, 1878. It was subsequently illustrated by working drawings, half size of the machine, in SUPPLEMENT, No. 133. Persons who may like to see engravings of this curious appliance, which can reproduce the voice of the dead, can do so by referring to the volume of 1878, or have the two numbers mailed to them from this office for 20 cents.

IMPROVED GRATE-FIRE BLOWER.

The accompanying engraving represents a very simple and effective device that may be used as an ordinary blower to be applied to grate fires, or it may be adapted to serve as a deflector for carrying the dust up the chimney during the raking of the fire, and especially while taking up the ashes from under the grate. The blower is composed of four triangular sections, pivoted together at their acute angles, to permit of their being folded one upon the other. When folded, the apparatus presents the same appearance, and may be used in precisely the same way, as the common blower, as shown in the left hand view. But when the parts are extended, as represented in the right hand view, the blower forms a hood or shield, beneath which there is ample room to manipulate the fire, and which so increases the draught that all the dust will be drawn up the chimney, thereby relieving the apartment of the layer of dirt that usually accompanies every attention paid to a grate fire. The blower is held in an extended position by two rods hinged one upon each side of the outer section, and the free ends of which enter holes in the inner section.



THOMPSON'S IMPROVED GRATE-FIRE BLOWER.

This invention has been patented by Mr. Chas. D. Thompson, of No. 240 Fifth Avenue, New York City.

A NEW copper mine has been discovered near Coquimbo, in Chili.

Metallization of Organic Matter.

However cleverly the artist may exercise his powers of imitation, nature can always excel him, and hence it is that especial interest attaches to all processes for preserving natural objects for artistic and decorative purposes. Among the most recent efforts in this direction may be mentioned the improvements in the preparation of organic matter for metallization by galvanic deposit recently introduced by La Societe anonyme de Metallisation artistique des Animaux, Vegetaux, ou autre corps, of Paris, described in the *Industrial Review.* This process consists in the employment of an albuminous liquid, with which the different substances in question are treated to prepare them for metallization, and may be thus obtained: A quantity of snails or slugs are first washed in ordinary water to free them from all earthy or calcareous matter; they are then placed in a vessel containing distilled water, and are left here sufficient time to give off slowly their albuminous matter.

The albumen thus obtained is now filtered and boiled for about an hour. After the boiling is added a quantity of distilled water sufficient to replace that lost by the boiling, and about 3 per cent of nitrate of silver. This liquid is then placed in bottles hermetically closed and kept in the dark. It will thus keep without any alteration. To use this liquid for the preparation of the objects, about 30 grammes of it is dissolved in about 100 grammes of distilled water. In this solution the objects are submerged for a few moments; they are then placed in a bath consisting of distilled water with about 20 per cent of nitrate of silver in solution, and afterward submitted to the action of hydro-sulphuric gas to reduce the nitrate of silver adhering to the albumen-covered surface of the object.

Thus treated, all organic matter is rendered fit to receive a galvanic deposit; and the galvanic products obtained by this process are far superior in fineness and neatness to those obtained by any other known process. Even the finest and most minute fibers and veins, the smallest unevenness of surfaces, and hairs scarcely visible to the naked eye are clearly discernible, and come out with striking neatness, the metallic deposit being of perfectly uniform thickness and adherence.

Professional Fatigue.

Medical and other professional men often break down from their inability to keep a regular time for meals. An eminent doctor says:

"Being often out for many hours, and becoming too exhausted to digest a full meal when at length able to get it, I conceived a plan which answered admirably well, and which other doctors have gladly adopted. I provided myself with a small bottle of lime water, which I add to a glass of milk when passing a dairy shop; or I put a small flask of the mixture in my pocket. A water biscuit with this will keep a man harmless on a long fast, and enable him to digest a meal when he can obtain it."

Fire and Water, formerly *The Fireman's Journal*, of this city, suggests that grates in second stories are usually less safe than those below, as the narrower joists give little room for the boxing of the hearth. It also adds that grates should be examined carefully to determine whether the back of the flue is simply a four inch wall, which is always dangerous at the back of a grate in a frame house. This can be determined by measuring the distance the breast extends out from the wall; sometimes the breast runs through flush with face of wall in next room; if so, calculate accordingly. Proper attention paid to flues and all connections therewith would prevent many fires.

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Correspondence.

Phosphorescent Cranes.

To the Editor of the Scientific American:

In a late issue Mr. Worrall refers to the phosphorescence of cranes, etc. The reason that it is not referred to in scientific books is that hitherto, as far as my knowledge goes, very few people have observed it, and Mr. W.'s testimony is extremely valuable and interesting. I have never doubted that the powder down patches of some of these birds were luminous at certain times.

Twenty years ago an old hunter and experienced observer told me that he had observed it on the Florida Reef, and I made a sketch from his description, and it will be found in an article of mine in *St. Nicholas* of May, 1881. Since then I have been unable to find a single naturalist or collector who has ever observed it, though several had heard of it. Mr. Hornaday has probably had as much experience as a collector and field worker as any one in this country, yet he wrote me some time ago that he had never heard of it. Mr. Charles Harris, an ornithologist of Pasadena, tells me that in entering a heronry at night, in Maine, he noticed a number of lights there, which disappeared with the birds. C. F. HOLDER.

Pasadena, Cal., March 3, 1887.

Balance Pivots.

It is not too much to say that 40 per cent of watches that are left for repairs have the balance pivots injured; at least, there is quite that proportion of them that would be improved by having these pivots touched up and burnished. A pair of brass runners should be fitted to the turns, and kept for this purpose only; the right hand runner having a series of small holes drilled in its one end, on face, to fit various sized pivots as near the circumference as may be, the runner being turned away at the back of these holes sufficiently to give room for operating on the ends of the pivots; on the other end of this runner a series of facets is made, with nicks in the middle of them, as beds for the different sized pivots. On the left hand runner an eccentric point is made, and a center made in the point to correspond with the pivot beds in the right hand runner. A very small flat burnisher, with one of the corners rounded off, is easily made, and should be kept for burnishing pivots.

If the injured pivot is put in the bed in the turns, and the burnisher applied to the straight part of the pivot, then the runner reversed and the end of the pivot rounded, it will be found that a burr has been thrown up on the corner, which must be removed and the operation of burnishing the side and end of the pivot gone through again. Nothing but a burnisher should be used in repairing pivots that are damaged in this way, as if a file or slip of oilstone is used, you are likely to spoil the pivot; but the burnisher should be kept sharp and constantly rubbed on the emery board, which is the usual thing to rub a burnisher on; but a lead block with a planed surface is much better, as it keeps the burnisher flatter and smoother, and a burnisher rubbed on the lead cuts as fast as one with a coarser surface.—*W., J., and S.*

Inhabitants of Other Worlds.

The *Popular Science News* presents in a late issue an article bearing on this subject, in which it sets forth one reason why such bodies as the moon, Jupiter, and Saturn could not be inhabited by beings of the same physical constitution as mankind, even supposing that other conditions governing existence there should be favorable, which is not the case. The argument in question depends on the action of gravitation at the surface of these several bodies. Thus, at the moon's surface, the force of attraction being very much less than at the earth's surface, a being constituted like man, and endowed with the same muscular energy, could leap to astonishing distances—clearing, for example, a three-story brick house with the same ease that he would clear a post and rail fence on the earth; the elephant would become as light footed as the deer; a stone thrown from the hand of a thoughtless boy might fall in an adjoining county before accomplishing its mission of destruction; armies could engage each other in battle at great distances apart; and all kinds of labor would be greatly lightened by reason of the diminished weight of tools and materials. While this state of things might not render human life, endowed as we have it on earth, impossible on the moon, the opposite state of things which would prevail on Jupiter and Saturn would certainly render life, in reality, a burden. The masses of Jupiter and Saturn, being so much greater than that of the earth, the correspondingly greater attractions which they would exert would so impede locomotion that unless endowed with enormously greater muscular power than he is gifted with on the earth, man would only be able to crawl along as though his feet were weighted with lead, while the larger animals, in all probability, would be crushed by their own weight.

The Use of Steam.

For years economy in fuel has been the subject of much study, and has caused a vast amount of discussion, and has been primarily responsible for many types of steam generators and attachments, patent settings, and cheap fuels, all possessed of varying degrees of merit, or otherwise, as the case might be. This question seems to the writer* to have been studied by engineers and manufacturers to the exclusion of a proper consideration of the economical use of the steam after it is generated, with the single exception, perhaps, of its use in engines for power purposes, which branch has received much attention, in spite of which, any decided improvement in their performance does not appear to have been recently made, and the engine remains a very wasteful machine, although, if we glance at a few of the legion of advertisements of as many makers, and read the claims therein set forth, it would appear that little or nothing remained to be accomplished in this direction. But we hear so much said of the amount of fuel used and wasted, and the great cost of furnishing steam in our manufacturing establishments, it will be well to consider where it goes in some of the more ordinary cases, and call attention to the amount absolutely necessary to do certain kinds of work. We shall consider but a few of the many establishments requiring steam in the production of their goods, and first we will consider its use in a paper mill, not for the whole plant, but for one or two principal departments only, and for illustration we will assume that the mill produces five tons of finished paper daily.

The felted paper, as it passes from the squeezing rolls to the drying cylinders, carries from 60 to 70 per cent of water by weight; probably the average is not far from 65 per cent. It will therefore be seen that we have to evaporate 6,500 pounds of water per day, and that, too, from a low temperature, to do the drying alone. To this must be added the loss due to condensation resulting from the loss of heat from the exposed surfaces of the drying machine and its connections, which will be from one-third to one-half of a pound of water per hour for each square foot of exposed surface, according to circumstances.

The rotary bleacher will, if of the usual size, require about three thousand pounds of steam to bring it to the boiling point, and the radiation from it will result in the condensation of about 180 pounds of steam per hour.

The heating of the mill, the pipes in the drying lofts, and all exposed pipes will require about one-half pound of steam per square foot of surface per hour to make good the loss by condensation.

In bleacheries for cotton cloths and yarns, one pound of water evaporated in the generators will bring to a boiling point five pounds in the bleach, to which must be added the loss by radiation of heat. Dye-becks, scouring and washing machines, etc., will require steam in the same proportion. Cotton yarns, cotton in the bat, stockinet goods, etc., as they come from the hydro-extractors, carry about 38 per cent of moisture, in fact, several weighings by the writer of goods from the extractor and from the drying rooms showed a variation of less than 1 per cent from the above.

Light ducks, drills, and jeans were found to contain about 50 per cent of moisture by weight as they passed to the drying cylinders, and by carefully collecting and weighing the water of condensation from the driers, it was found to agree very closely with the amount which estimates showed would be required to evaporate the quantity of moisture carried by the goods, as stated above, after making due allowance for the loss by radiation of heat from the exposed surfaces of the drying machines. It should be mentioned, however, that the quantity collected has in every case exceeded, though but slightly, the estimated amount required.

A tentering machine operated in a closed room, with the temperature varying from 132 to 140 degrees Fahr., condensed slightly more than one-half pound of steam to each square foot of coil per hour, the steam pressure varying from 35 to 40 pounds per square inch; had the pressure been higher, the condensation would have been greater, and more work could have been done.

Of woolen yarns the writer has not had so good an opportunity to ascertain the quantity of water remaining to be evaporated, but from limited trials made would expect it to range from 50 to 60 per cent.

We have touched, and but lightly, some of the processes requiring a large quantity of steam, and would add that this quantity is absolutely necessary under the most favorable conditions. One fact should never be lost sight of by the manufacturer, viz., whenever machinery is put in that requires steam in its operation, the sharp competition among the different makers of such machinery leads to their estimating and claiming, as features of such machines, the consumption of the minimum quantity of steam to do a certain amount of work, while similar causes tend in the opposite direction in the rating of the capacity of steam generators, that is, they are usually rated at their maximum capacity. This not infrequently leads to putting down insufficient boiler power, thus causing disappointment and dissatisfaction.

From the foregoing, it will be seen the amount of steam necessary to do certain kinds of work is very considerable, and no arrangement can be devised that will in the least degree render the amount any smaller. In addition to the amount actually required to do the work, there will always be a certain amount lost by condensation in pipes, etc., and this quantity may easily become quite a large amount, as the following case will illustrate. A boiler to be used for heating purposes only was put in, and its capacity was sufficient to just supply the radiators and nothing more, under the most favorable conditions. The system as arranged had a very large quantity of piping, its only fault, as otherwise the arrangement was good. When started, the whole system seemed a failure, and gave great dissatisfaction. Investigation disclosed the fact that the supply and return pipes alone had radiating or cooling surface enough to condense all the steam the boilers could economically generate.

So we find steam carried long distances and in many directions, in our large manufacturing establishments, and the heat lost in this manner sometimes bears no inconsiderable proportion to the whole amount used. It should also be borne in mind that the higher the pressure and temperature, the greater will be the proportion of loss from this source.

*F. S. A. in *The Locomotive*, published by the Hartford Steam Boiler Inspection and Insurance Company.

Danger Lurking in the Chimney Top.

"Observer," in the *St. Louis Miller*, says: A long experience in burning wood fuel in both heating and cooking stoves has brought out a danger point in this combustion that may throw light on some of the unexplained fires that from time to time occur in both city and country, and especially in the country. Being much annoyed by rain running down inside the flue, I procured a sheet iron cap for one flue and a fire clay T cap for the other. After that time I was every now and then troubled with the flues being on fire, and in several instances the roof took fire outside. After a long experience of this kind the iron cap was removed, and no more fires have been in that flue or on the roof of that building.

This led to a close watch over the other building, which had the stove pipe enter into a fire clay pipe flue of six feet, ending in a T top on the outside. The fire clay flue rises through an attic. The frequency of fires led to very careful examination into all the associated conditions. Thus I find that the colder the weather is, there is not only increased combustion, but increased condensation of the elements of the wood carried up in the smoke, and, striking against the top of the cap, is retarded in its emission, and water and a tarry substance containing an inflammable oil is thrown back down the flue, and gathers on the top and around the openings of the top, often dropping on the roof. This substance is easily ignited, and the flue, the top, and the matter on the roof all burn with great force, and is a source of great and constant danger.

Experiments show that angles, bends, or numerous pipes entering the same flue, by retarding or impeding the direct draught, tends to this deposit by favoring condensation. The process is similar in action to the retort. It is the production of an empyreumatic oil by the destructive distillation of wood.

I have tried burning zinc, sulphur, salts, etc., but all fail; direct draught, no obstruction by caps, and frequent troublesome cleanings are the only preventives of the danger. The soot, of itself, has little or no inflammability. Attention to this subject may be of value both to owners and insurance companies, and scientists may find a way by which to utilize the inflammable products which enter so largely into all our domestic enjoyments.

This whole subject of domestic combustion is worthy of close attention, as being associated with interests and dangers of very great importance.

A Serious Railway Accident.

On the morning of the 14 inst., while a train of nine passenger cars on the Boston and Providence Railway was passing over an iron Howe truss bridge that spanned south at roadway near Boston, the bridge suddenly gave way, after the engine and three cars had passed over; the remaining portion of the train, consisting of six cars, was precipitated into the street 25 feet below. All the cars were crowded with passengers going in to Boston to their accustomed avocations. What added to the horror of the accident was that the cars plunged down one upon the other, so that the forward cars that fell were then again crushed by the weight of others. It is estimated that about forty persons lost their lives, while about one hundred were wounded. The exact cause of the breaking down of the bridge has not yet been ascertained, but is believed to be due to its weak and rickety condition and lack of thorough examinations. Each of the cars was provided with a safety stove, and the value of the invention was effectively proved, as the stoves were found intact, with their doors locked. This shows that car stoves may be made safe, if the railway managers choose to make them so.

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SCIENCE IN TOYS
VIII.

THE SCIENTIFIC USE OF THE TOY MAGIC LANTERN.

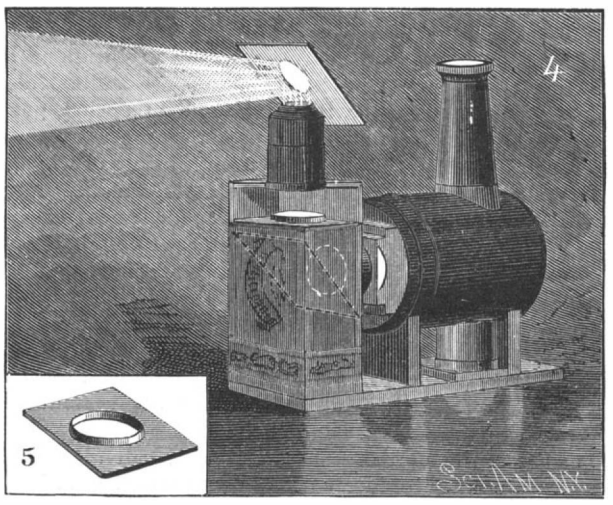
A toy magic lantern is generally considered as worthless as any piece of apparatus one can own. Usually, in these instruments, the source of light is unsatisfactory, the light is wasted, and the little light finally rendered available is passed through imperfect lenses, yielding results which are anything but pleasing. Generally, toy lanterns have been made without condensers, and almost without exception they are found to be of an odd size, which will not receive an ordinary lantern slide, so that the user must remain content with the daubs usually accompanying such instruments. Recently, however, some improvement seems to have been made in toy lanterns. The writer, in looking about for a toy lantern suitable for this series of experiments, came accidentally upon a type of lantern which in cheapness, compactness, generally good design, finish, and efficiency excels all others with which he is acquainted. Still it has a serious defect, that is, considerable spherical aberration. This can be easily remedied by replacing the front lens of the objective —which is a double convex of four inch focus—with a meniscus (periscopic) spectacle lens of the same focus.

This lantern is shown in side elevation in Figs. 1 and 2 respectively. It is made of several sizes, but the size which costs $3.75 or $4 is as small as can be used to advantage in the experiments illustrated in the annexed engravings.

The lantern is 12½ inches high, including chimney; the cylindrical body is 5 inches in diameter and 6½ inches long. The back of the body is closed by a spun, concave reflector. The condenser is a double convex lens, 2⅜ inches in diameter and 4 inch focus. The rear lens of the objective is a double convex, 2⅜ inches diameter and 5½ inch focus, and the front lens is, as already stated, 4 inch focus and its diameter is 1¼ inches. The optical combination is not the best that can be devised, but it answers a very good purpose.

The lamp has a kerosene burner of approved type, and is provided with a tall chimney, which insures perfect combustion and a white light. The reservoir of the lamp, as well as the objective tube and lantern chimney, are nickel plated. The space in which slides are introduced is one-sixteenth of an inch too narrow for average slides, but, if desirable, a clever tinsmith can correct this in a very short time.

It is not intended to treat of the projection of pictures with this instrument; but it may be said, in passing, that the lantern, when altered as suggested, projects a very good picture, 6 feet in diameter. A little camphor added to the kerosene increases the light perceptibly, and a clean chimney and clean lenses go a long way in the utilization of the light.



VERTICAL ATTACHMENT.

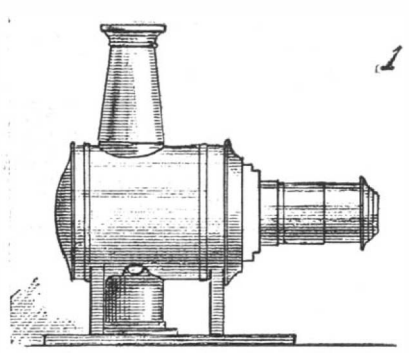
The number of interesting experiments which may be successfully performed with this little lantern is surprising. Certainly a long evening of rational and instructive amusement may be gotten out of the lantern with little expense beyond the cost of the instrument itself, and with very little trouble.

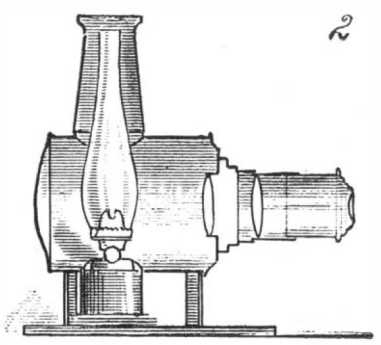
The production of cohesion figures on the screen is a simple and interesting experiment. Between two glass plates of a width suitable for the lantern is placed a small amount of vaseline, either plain or colored with alkanine or aniline. The plates are pressed together until all of the air is expelled, and a thin film of vaseline remains. The glasses are then clamped together by means of two stout rubber bands.

The slide thus prepared is placed in the lantern, and the point of a knife blade is introduced between the upper corners of the glass plates. Upon the smallest separation of the plates, arborescent figures will appear on the screen, which will grow as the plates are further separated, appearing as shown in Fig. 3 like a growth of cactus or fern. On removing the knife blade, the plates will be drawn together by the rubber bands, and the figures will disappear. The experiment may be repeated again and again with the same charge of vaseline, but it will, in time, become so thin as to require renewal.

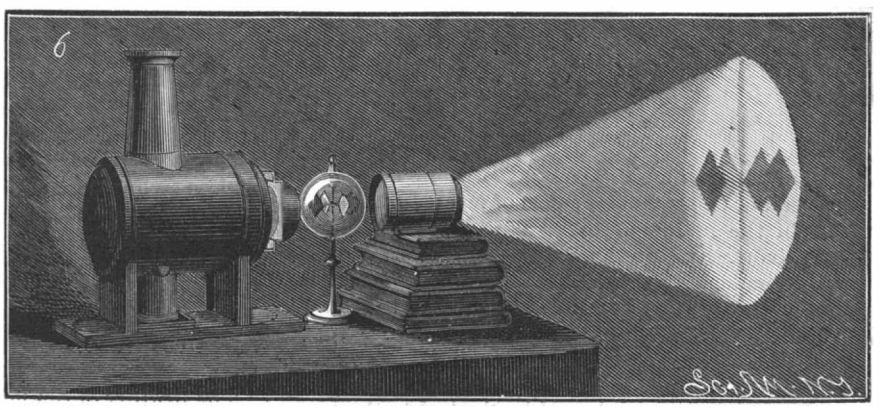
In Fig. 4 is shown an attachment for converting the instrument into a vertical lantern. The objective is removed from the lantern, and a cigar box of suitable height is arranged with its open side next the front of the lantern. In the box opposite the condenser of the lantern is arranged a piece of ordinary looking glass at an angle of 45°. In the top of the box is made a hole for receiving the objective. In the box, an inch and a half from its upper end, is arranged a horizontal transparent glass plate, and above the glass plate the box is cut away diagonally across the corners, leaving only material enough in the end to hold the objective. A second mirror, arranged parallel with the first, is supported over the end of the objective, and serves to throw the image on the wall. If the experimenter will be satisfied with images on the ceiling, the second mirror may be dispensed with.

The tank shown in Fig. 5 is designed to hold various liquids used in experiments in the vertical lantern. It consists of a plate of glass to which is secured a ring of tin, by means of a cement composed of pitch, gutta percha, and shellac, equal parts, melted together. In this tank may be placed clean water. A cambric needle, carefully laid on its side on the surface of the water, will float, and the needle and depression in the water formed by the needle will show plainly on the screen. If the needle be magnetized, it may of course be attracted and repelled by a magnet. A few bits of gum camphor thrown on clean water will move about in a curious way. A few drops of a solution camphor in benzole, dropped on the water, yield very interesting results. Curious effects are produced by a drop of some of the essential oils. The oils

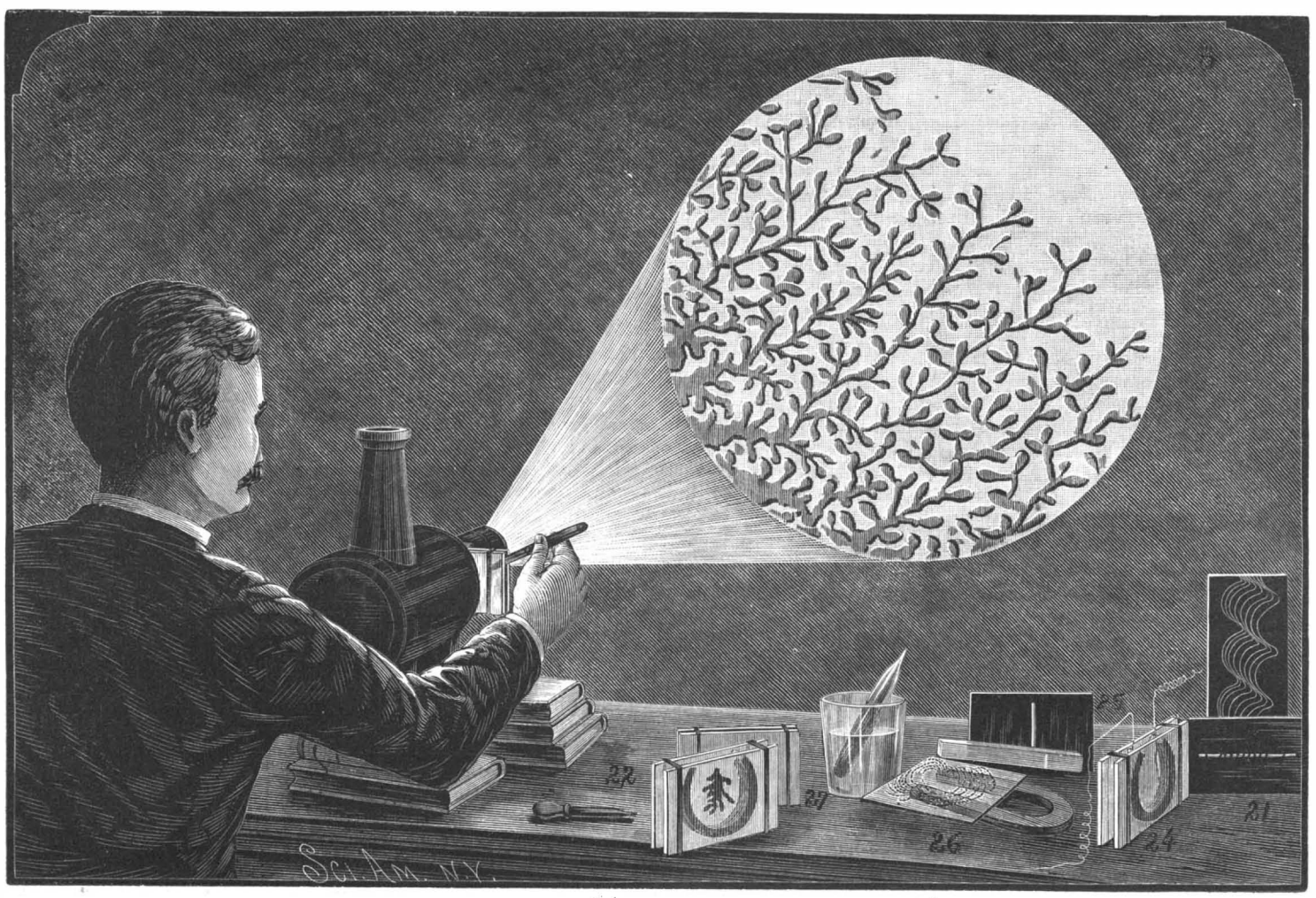




TOY MAGIC LANTERN.



ARRANGEMENT FOR PROJECTING APPARATUS.



PROJECTION OF COHESION FIGURES, AND OTHER EXPERIMENTS.

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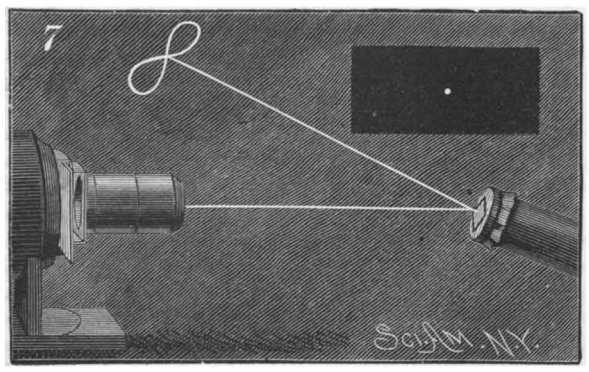
of cinnamon, coriander, and lavender, are examples. In Fig. 6 is shown the method of projecting a piece of apparatus; in the present case, a radiometer. The objective is removed from the lantern, and supported a short distance in front of it, and the apparatus is placed between the lantern and objective.

In the case of the radiometer the heat of the lantern causes radiometer to revolve, so that it is seen in motion on the screen.

In Fig. 7 is shown a simple device, known as the opeidoscope. It consists of a short paper tube, having a thin piece of rubber stretched over it and tied. A

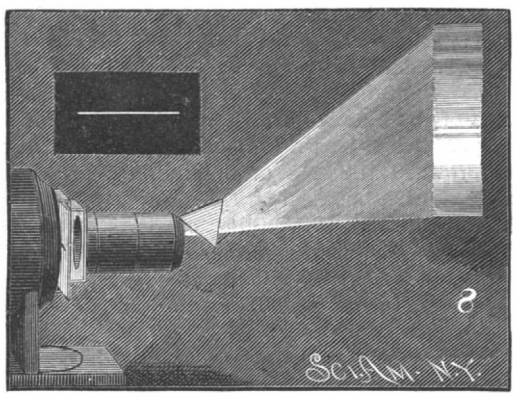


THE OPEIDOSCOPE.

small piece of mirror is cemented to the center of the rubber.

The perforated card shown in the corner of the engraving is inserted in the lantern, and a pencil of light is allowed to fall on the mirror, and when different notes are sung into the open end of the paper tube, the reflected pencil of light will form intricate figures on the wall.

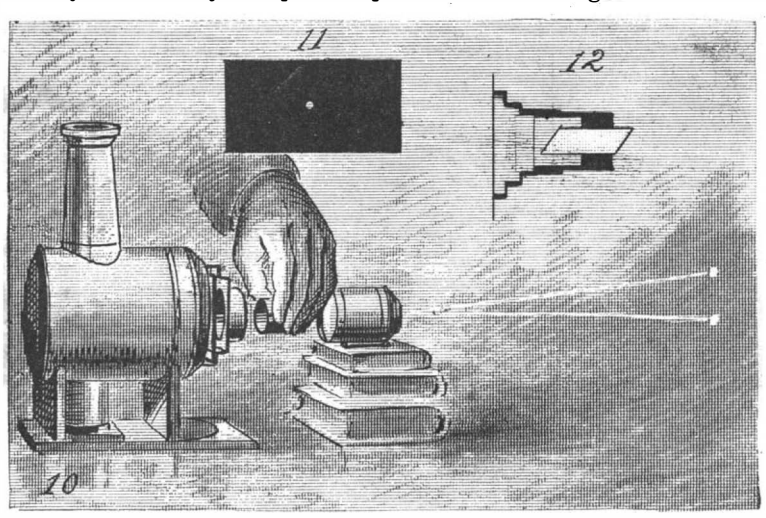
In Fig. 8 is shown the method of projecting the spectrum. The card shown above the lantern has a central longitudinal slit about three-sixteenths inch wide. This card is inserted in the lantern, and the



PROJECTING THE SPECTRUM.

slit is focused on the screen. An ordinary glass prism is now placed in front of the objective, and turned until the best effects are secured.

In Fig. 10 is shown an experiment in double refraction. The perforated card shown in Fig. 11 is inserted in the lantern, and the objective is arranged as described in connection with Fig. 6. The aperture of the card is focused on the screen, and a crystal of Iceland spar is placed between the lantern and the objective. Two images of the aperture of the card will appear on the screen, showing that the ray has been divided or doubly refracted by the spar. A permanent mounting

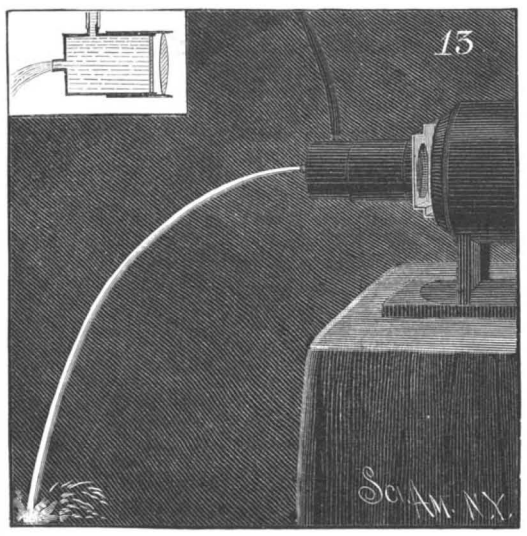


DOUBLE REFRACTION.

for the spar may be arranged as shown in Fig. 12, the spar being mounted in a cork fitted to a tube adapted to the lantern front.

In Fig. 13 is shown a device for producing a luminous fountain. A tube is fitted to the rear half of the objective tube and closed at the rear end by a glass disk, cemented in by means of the cement above described. The front end of the tube is closed, with the exception of an orifice three-eighths inch in diameter, in which is inserted a smooth tube about one-half inch long. A nipple projects from one side of the fountain tube, for receiving the rubber supply pipe, which may either be connected with the house water supply or it may be used as a siphon, taking water from an elevated pail or tank. Only a small head is necessary to secure the desired results. The stream will be illuminated throughout its entire length, if a smooth flow of water is secured, and it may be tinted by inserting colored plates of glass in the slide receiver.

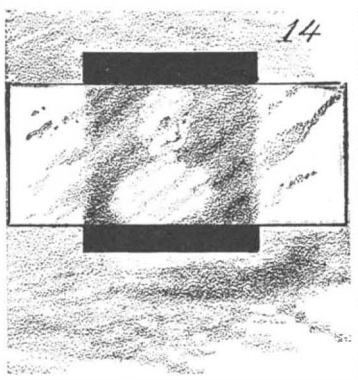
In Fig. 14 is shown some curious effects of refraction. A portrait is placed in the lantern, and in front of it is



LUMINOUS FOUNTAIN.

placed a piece of wrinkled window glass, which is slowly moved back and forth, the curved surfaces of the glass producing distortions of the face which are sometimes ludicrous.

In Fig. 15 is shown a kaleidotrope, which illustrates persistence of vision. A card having several circles of small perforations, say one-eighth inch, is cemented at its center to one end of a short spiral spring, the opposite end of the spring being cemented to a plate of glass which fits in the lantern. By placing this slide in the lantern and striking the card so as to cause it to vibrate in different directions, a great variety of curves will be described on the screen by the light spots, and owing to the persistence of vision, these curves will be seen as continuous lines.



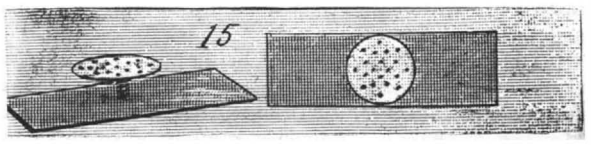
REFRACTION.

A disk of perforated cardboard or tin pivoted centrally to a plate of the same material, as shown in Fig. 16, exhibits a certain phase of interference when it is placed in the lantern and the disk is revolved slowly. This is a very simple device, but it is well worth the trouble of making.

Fig. 17 shows a cardboard disk provided with radial slots, and pivoted on the end of a handle. It is designed to be whirled in front of the lantern tube, to interrupt the light beam, to show the effects of intermittent light on moving objects.

The slide shown in Fig. 18 is designed to show the tiring of the eye, by the observation of a semicircular light spot on the screen, for a considerable length of time, then quickly providing a similar spot, having the same illumination, for comparison.

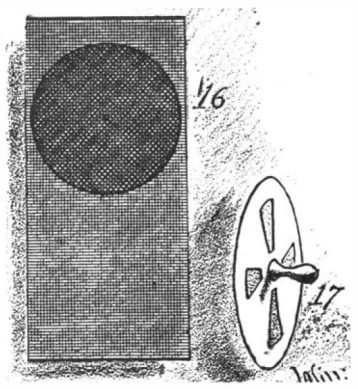
This slide is made by cutting in a slip of pasteboard two semicircular holes, with a bar between, then arranging a card to cover the lower semicircular hole, while the upper one is open. The card is attached to one end of an elastic band, the other end of the band being fastened to the pasteboard slip. The card is provided with a string, by which it may be held in place over the lower aperture of the slip. After the slide is exposed in this condition for a few seconds, and the eye becomes wearied by viewing the white spot on the screen, the card is released, and the rubber withdraws it from the lower semicircular aperture, when both halves of the circle will appear, and although they are equally illuminated, the half longest on the screen will appear much darker than the other. The slide shown in Figs. 19 and 20 is designed to illustrate the wave theory of light. The plate, Fig. 20, which fits the lantern, is made of a glass photographic negative plate, exposed and developed to render it opaque. A number of parallel scratches are formed one-eighth inch apart in the film by means of a large needle. The slide, Fig. 19, should be of the same width as the plate, Fig. 20, but three or four times as long. Upon this slide, which is also a piece of negative glass, is scratched a sinuous line, covering about one-third the width of the plate. This line is easily made by the aid of a sheet metal pattern laid out by means of compasses. By placing the plate with the parallel scratches in the lantern, and moving the slide over it, a series of dots, representing ether particles, will be seen to move up and down on the screen without advancing, but the waves formed by the dots move on.



KALEIDOTROPE.

In Fig. 21 is shown a device for illustrating the compression and rarefaction of air in sound waves. This slide differs from the other in having a single straight slit on one glass, and on the other glass a series of sinuous slits gradually advancing in position in the series. By moving the long plate over the short one, series of dots representing air particles will be seen to advance toward and recede from each other.

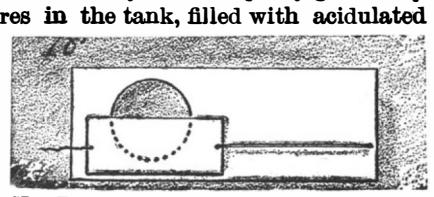
In Fig. 22 is shown a vertical tank which is thin enough to enter in the place of a slide in the lantern. This tank is formed of two plates of glass and a segment of a fruit jar packing ring. If one ring is not thick enough, two may be used. The rings are coated on opposite sides with shellac varnish, and immediately placed in position between the glass, and the glasses are bound together by means of stout thread or, better, fine wire. The tank may be used immediately.



PERFORATED TIN AND APERTURED DISK.

The following are, in brief, some of the experiments to be tried with this tank. Place in it clean water, and while it is in the lantern drop in a small quantity of ink.

Try alcohol or glycerine in water, in the same way. Put in a weak solution of nitrate of silver, add a drop of solution of common salt. To a weak solution of blue litmus add a little vinegar or other acid. The solution turns red; add a little ammonia, and the solution again becomes blue. These are striking experiments, and there are many others equally good. By placing two wires in the tank, filled with acidulated water (Fig. 24), and attaching a battery of sufficient power to the wires, the decomposition of water may be shown.

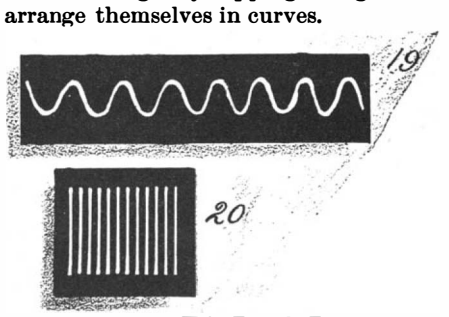


SLIDE SHOWING THE TIRING OF THE EYE.

In Fig. 25 is shown a device for exhibiting refraction. A card, having a slit one-sixteenth of an inch wide and about two inches long, is placed in the lantern, and in front of it is held a strip of plate glass. So long as the glass is parallel with the card, no effect is produced; but when the glass is held at an angle with the face of the card, the line of light passing through the slit is bent aside or refracted.

Magnetic curves (Fig. 26) are shown on the screen by placing the magnet on the vertical attachment, placing on the magnet a glass plate, sprinkling on the glass a few iron filings, and then gently tapping the glass to cause them to arrange themselves in curves.

The chemical thermometer (Fig. 27) is projected after warming it until it is quite blue, then dipping it into a glass of cold water in the field of the lantern. The changes from blue to pink are very pretty. The change begins at the outside.



LIGHT-WAVE SLIDE.

By coating glasses with solutions of various salts, crystallization may be seen in progress on the screen.

By means of a simple magnetic needle mounted on a point cemented to a glass plate, and used in the vertical attachment, various experiments in magnetism may be performed.

No attempt has been made to treat the subject exhaustively, but enough has been suggested to show that a considerable amount of experimentation may be done with a cheap lantern and easily made accessories.

G. M. H.

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ROUGERIE'S ANEMOGENE.

Monseigneur Rougerie, Bishop of Pamiers, in France, has been laboring to establish experimentally the theory that the rotation of our earth must be the principal cause of the currents and winds in our atmosphere. Ordinary text-books, such as used at schools, explain that the regular winds, the trade winds, and monsoons, for instance, are due primarily to the action of the sun; the rotation of the earth being regarded as a secondary factor. In Ganot's "Physics" the explanation is much as follows:

"The air above the equator being gradually heated, rises as the sun passes from east to west, and its place is supplied by the colder air from the north or south. The direction of the wind, however, is modified by this fact, that the velocity which this colder air has derived from the rotation of the earth—namely, the velocity of the surface of the earth at the point from which it started—is less than the velocity of the surface of the earth at the point at which it has now arrived. Hence the currents acquire, in reference to the equator, the constant direction which constitutes the trade winds, *i. e.*, from the northeast on the northern, and the southeast on the southern hemisphere."

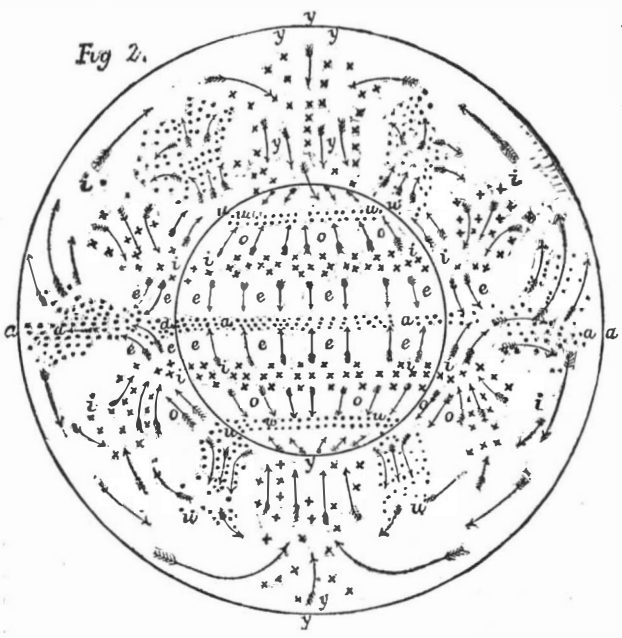
This means, in other words, that the sun creates a wind from the poles to the equator, blowing from the north on our hemisphere. The rotation of the earth changes this wind into a northeast wind, but the rotation is not the cause of the wind.

Monseigneur Rougerie takes exception to this view. He does not at all deny that a great many atmospheric disturbances result mainly from differences in temperature. If air above a certain area is heated more than over adjacent spaces, it expands, becomes lighter, rises, and flows off in the higher altitudes toward the colder regions. The equilibrium at the surface of the earth is destroyed at the same time as the barometric pressure on the colder area is greater; we have, therefore, on the surface a current of cold air rushing toward the warmer spaces, the velocity of which depends upon the difference in barometric pressures. All winds so produced, however, even if we include the monsoons of the Indian Ocean, are of a local character. And since Monseigneur Rougerie has mechanically, without applying heat, imitated the monsoons, he is all the more inclined to assign the primary cause of the air currents to the rotation of the earth.

Monseigneur Rougerie affirms that an artificial terrestrial globe, in rotation in the surrounding air, produces on its surface air currents similar to those of the atmosphere; and his "anemogene," or wind producer, shows the ordinary trade winds, the equatorial and tropical calms, the return trades, the monsoons, etc., so that his theory, as we shall more fully see, is certainly based on good experimental data. His first rather primitive apparatus is illustrated in Fig. 1, which needs little explanation. The leather cord, C D E, passes over two pulleys, D and E, and imparts motion to a vertical shaft on which the two globes, A and A_1, are fixed. The frame, F, is of iron, and about 18 in. high; the box, G, serves as a stand or case for the apparatus. The globe, A (about 10 in. in diameter), was not perfectly smooth, but was provided with a number of meridional lines in relief, simply to produce a sufficient agitation of the air particles. Light fragments of down suitably suspended, or flames, were used to indicate the directions of the currents. The globe, A_1 (3 in. in diameter), revolved in water in the basin, B, and pieces of down compressed to free them from air served as indicators.

The speed of rotation appeared unimportant, though certain speeds showed certain phenomena best. The results were similar, both for the air and water media. On this point Monseigneur Rougerie states that "the rotation of a sphere in a medium less dense than itself, liquid or gaseous, always produces similar currents." Fig. 2 represents the results obtained, and shows the harmony between the wind currents produced with this primitive apparatus. In considering this diagram, we must bear in mind that the ordinary assumption explains those currents as arising from differences in barometric pressure due to differences in temperature, while Monseigneur Rougerie bases his theory on differences in air pressure directly due to the rotation.

We have already spoken of an ascending current in the equatorial region. This is the current *a a* of the sketch. The rising warm air flows back in the higher regions toward both poles, sinking slowly, and partly coming down to the surface at the tropics in a descending current (*i i*, Fig. 2), and returning toward the equator as trade winds from northeast and southeast (*e e*, Fig. 2), thus forming the first circular curve. The arrows, *e e*, point south and north, and the anemogene seems to be at fault on this point. In addition to the stronger currents, marked *e e*, there is, however, another current not indicated in the sketch. As the air between the tropics travels more slowly than the globe itself, rotating from west to east, a current from the east is generated. This



current combines with *e* to form the ordinary northeast or southeast trade wind. For the latitudes between the tropics and polar circles we have mainly, on our hemisphere, southwest winds, the so-called return trades, which have sunk down to the surface (*o o*, Fig. 2). Monseigneur Rougerie explains the tendency toward the west in these latitudes by the air there having a greater velocity than the surface of the earth. His experimental evidence is, however, not strong on this point. The reaction to the return trade, *o o*, is an ascending current, *u u*, near the 60th degree, which partly returns toward *i i*, and partly joins the original current from the equator toward the poles. Both united form at the poles a descending current, *y y*, which afterward reaches the surface as a southerly (or northerly) wind. These views account for the calm belts near the equator and the tropics, where the ascending and descending currents without horizontal motion are suddenly influenced by stronger trades and counter winds, causing the violent tempests which characterize the so-called calms.

In the volume* in which the then Abbe Rougerie first advanced these theories, he based them mainly on the charts of M. Brault, which are used by the French Navy, and on the works of Le Gras, Privat-Deschanel and Focillon, Reclus, Glaisher, Maury, Gifford-Palgrave, and others. Somewhat fancifully he assumes, in analogy with the rings of Saturn and the belts observed on Jupiter, that our atmosphere extends to a greater height at the equator than at the poles, so that the earth should carry with it a sort of atmospheric ring. We cannot follow him here in his interesting calculations, by which he wishes to prove for the North Atlantic basin that the simple rotation suffices to produce the barometric differences and the respective winds with their mean directions and velocities; but we may mention that there exists a remarkable agreement between his calculated isobars and those deduced from the observations of Dr. Wojeikow.

* Les Courants Atmospheriques autour d'un Globe en Rotation. Limoges, 1879.

Monseigneur Rougerie soon replaced his first globes by a much larger one in relief, which he is still perfecting, so as to make it more and more similar to our planet. This more recent anemogene, of which we give a view in Fig. 3, is a hollow sphere, 1·28 meters (4 ft. 2 in.) in diameter, and supplied with little vanes placed 5 degrees apart. Ordinary vanes would permit of observations only after the globe has come to rest; little needles are, therefore, fixed to the shaft ends of the vanes, which on the inside of the globe mark the positions of the vanes; and the globe is composed of several spherical shell pieces, so that hundreds of observations may be taken in a few minutes while the globe is rotating.

The assistant places himself inside the sphere and moves with it. A bell announces the number of rotations, that is, days. An equatorial velocity of 2 to 4 meters (6 ft. to 13 ft.) per second is supposed to be sufficient. The reliefs are as exact as possible, but a hundred times too high; this has been found necessary to make the vanes respond to the modifications which the relief of the continents effects in the wind directions. This new anemogene reproduces perfectly the trade wind on all oceans; the equatorial calms, their irregular distribution on the northern and southern hemisphere, and on the three oceans, and their sudden tempests; the transition of the northeast trades into the southwest monsoons of the Gulfs of Bengal and Oman; the great ascending current on the equatorial belt, and the line of minimum pressure there; the descending current of the Azores Islands, and the center of maximum pressure there; a similar descending current directed toward the area of maximum pressure in the South Atlantic, between St. Helena and the south coast of Africa; the two descending currents on the poles, right from the zenith, which must have a climatic influence; the southeast trade on the sea near Teneriffe, and the well known wind from the west near the top of the Peak.

There are also imperfectly reproduced the variable winds which occur between the tropics and the 50th degree, both north and south latitude; and also the winds in the zones between the 50th parallels and the polar circles. These imperfections cannot be wondered at. The apparatus is much too small, and the medium comparatively much too dense; the anemogene can never be more than a most modest approach to what the model of our planet ought to be. The main difficulty appears to be to give to the anemogene the proper atmosphere. The earth has a limited atmosphere, diminishing in density with the altitude; the anemogene is rotating in a medium of comparatively infinite extension, which has a uniform density. Hence it probably results that the direct effects, the ascending equatorial currents, and the trade winds are so well characterized; while the indirecteffects, as the return trades, appear less distinct. Nevertheless, the results claimed must be called remarkable.

That so easily explained a phenomenon as that of the monsoons, which simply appear to be land and sea breezes on larger scale, directly traceable to the sun's rays, should here appear as a necessary consequence of the rotation of the earth, will not be accepted without some hesitation; and as long as the experiments of Monseigneur Rougerie remain untested and unconfirmed, their apparent results will probably be questioned. Yet there seems no doubt

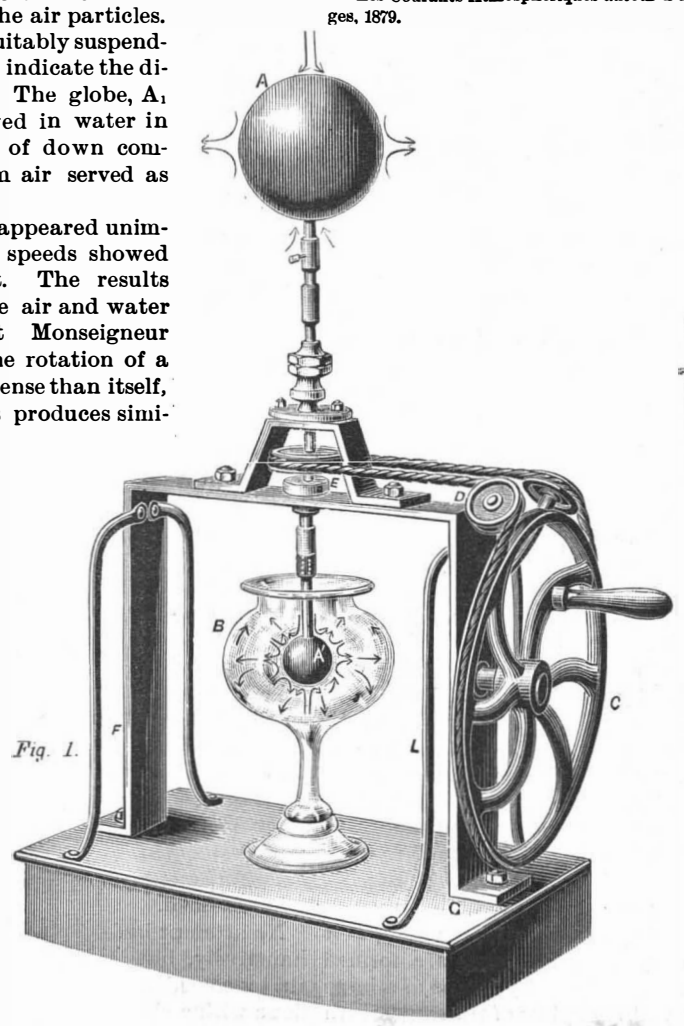
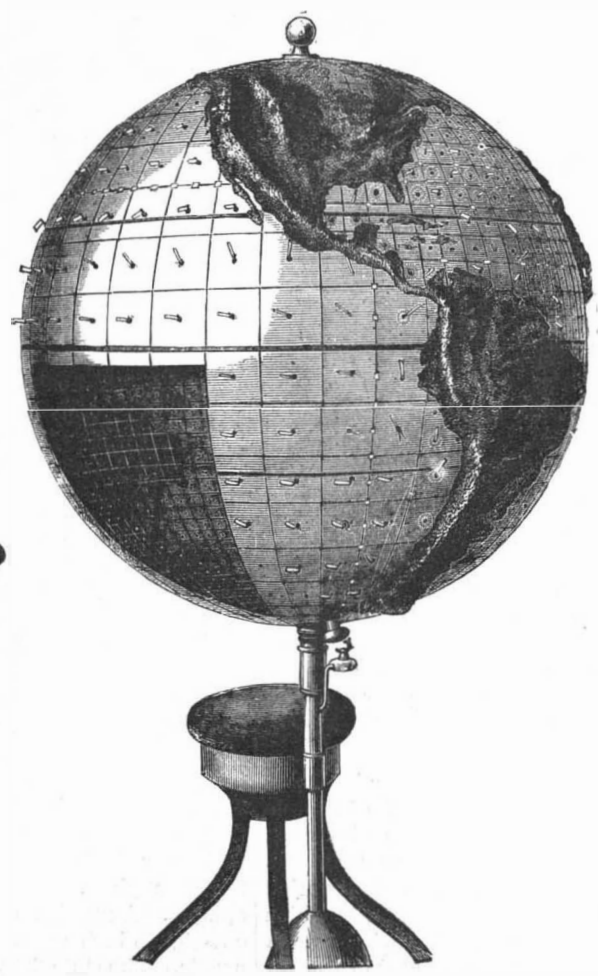


Fig. 1.



ROUGERIE'S ANEMOGENE.

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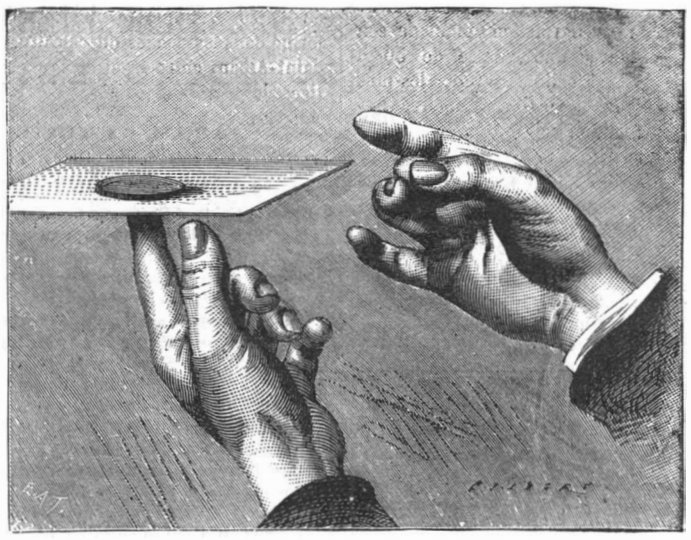
that we must acknowledge the cardinal point of Monseigneur Rougerie's theory, that the rotation of the earth is the principal cause of our atmospheric currents, and not the heat rays of the sun. We need hardly mention that Monseigneur Rougerie fully grants the great importance of relief, character of the surface, and other local factors, and especially also of the sun rays, but only in the second place. Whether the sun is thus to be partially relieved of one of his many onerous duties or not, further investigation will probably disclose. At any rate, the subject is a most interesting one.--*Engineering.*

THE PRINCIPLE OF INERTIA.

In treatises upon physics and mechanics, inertia is defined as that property of matter which prevents it from putting itself in motion when it is at rest, or from bringing itself to a state of rest when it is in motion. As we have before stated, it is by virtue of the principle of inertia that dust is expelled from our clothes when they are beaten, every particle of it tending to a state of rest. Although we have cited numerous experiments on the principle of inertia, we shall mention another one, which has been pointed out to us by Mr. H. Gilly, licentiate of sciences.

Upon the forefinger of your left hand, held vertically, lay a visiting card, and upon this place a silver dollar and try to remove the card without touching the coin. In order to do this, give the card a smart fillip with the fingers of the right hand and it will fly to a distance, leaving the coin balanced upon the forefinger. Care must be taken to give the fillip in an exactly horizontal direction, and in the plane of the card, as shown in the accompanying figure.—*La Nature.*



EXPERIMENT ON THE PRINCIPLE OF INERTIA.

EARTHQUAKE ON THE RIVIERA.

On Wednesday, February 23, early in the morning, the shores of the Mediterranean and the Gulf of Genoa, including both the French and the Italian coast, from Cannes to Spezia, were visited by a terrible earthquake, which destroyed some hundreds of lives. Its worst effects were felt along the Italian Riviera, west of Genoa, but especially between Oneglia and Savona, the central part of that coast, round the headland of Cape delle Melle, and in the small towns or villages of Diano Marina, Bajardo, and Bussano. The fashionable health resorts of English and foreign families within the French frontier, particularly Nice and Mentone, have suffered considerably; while Cannes, Monte Carlo, and the Italian seaside town of Bordighera, eleven miles from Mentone, as well as San Remo, were more fortunate. Inland, both through Piedmont and in the south of France, and to the east of the Gulf of Genoa, the shocks were felt nearly a hundred and fifty miles from the sea, affecting Lyons, Turin, Lombardy, and Tuscany; but the destruction of buildings and loss of life took place chiefly on the Genoese western shore. None of the English residents or visitors has been killed.

The first shock, or series of five quick shakings, was perceived, at Nice, two minutes after six o'clock in the morning; the second was about eighteen minutes afterward, and the third at twenty-five minutes to nine o'clock; but the two latter shocks were slight. People ran shrieking from many of the houses at the second shock, which brought down some buildings already shaken by the first; and in a few minutes every open space in the town, the Jardin Public, the Place Massena, Place de la Liberte, and other places were full of an excited, frightened mob of women and children.

The number of houses at Nice which were so much injured as to render it dangerous to enter them is about sixty. The inhabitants of almost all the top floors abandoned their homes. In addition to people living in tents, numerous families took up their quarters in coaches, covered vans, and carts of all descriptions. The bathing cabins along the sea shore were let out as living rooms. On the Promenade des Anglais the stands raised for the Carnival were used for people to sleep in. The directors of the Casino had thrown open that establishment as a shelter for the frightened people. The fear of more shocks of earthquake was so great that about 10,000 people, foreigners and inhabitants, left Nice on Wednesday. The greater number of people who had not fled took refuge on the heights of Cimies, where there were about 2,000 Americans, English, and Russians living under canvas. After the first shock, the Count and Countess d'Eu and the Duc de Nemours, who inhabit the villas des Caroubiers and Graziella, took refuge in their gardens, camping in the open air. On the other hand, the King and Queen of Wurtemberg had not left their house. The military authorities had pitched a large number of tents on the public places and squares, in order to provide shelter for the women and children; at night the soldiers patrolled the streets.

The steeple of the German church in the Rue Augsburg was thrown down. At the Church of St. Etienne, the spire and bell were shaken from their position, and fell through the roof into the church. The most serious accident, however, was at the Ecole Maternelle in St. Etienne. The house was completely shaken down, and the schoolmistress, Madame Cheylon, was buried in the ruins. She was quite dead when, by the efforts of the sapeurs pompiers, the body was recovered.

Cannes escaped almost without any serious damage to property or accidents to persons. At Cannes and at Antibes, when the second shock of earthquake occurred, the level of the sea sank over three feet, and then rose about six feet, before resuming its ordinary level.

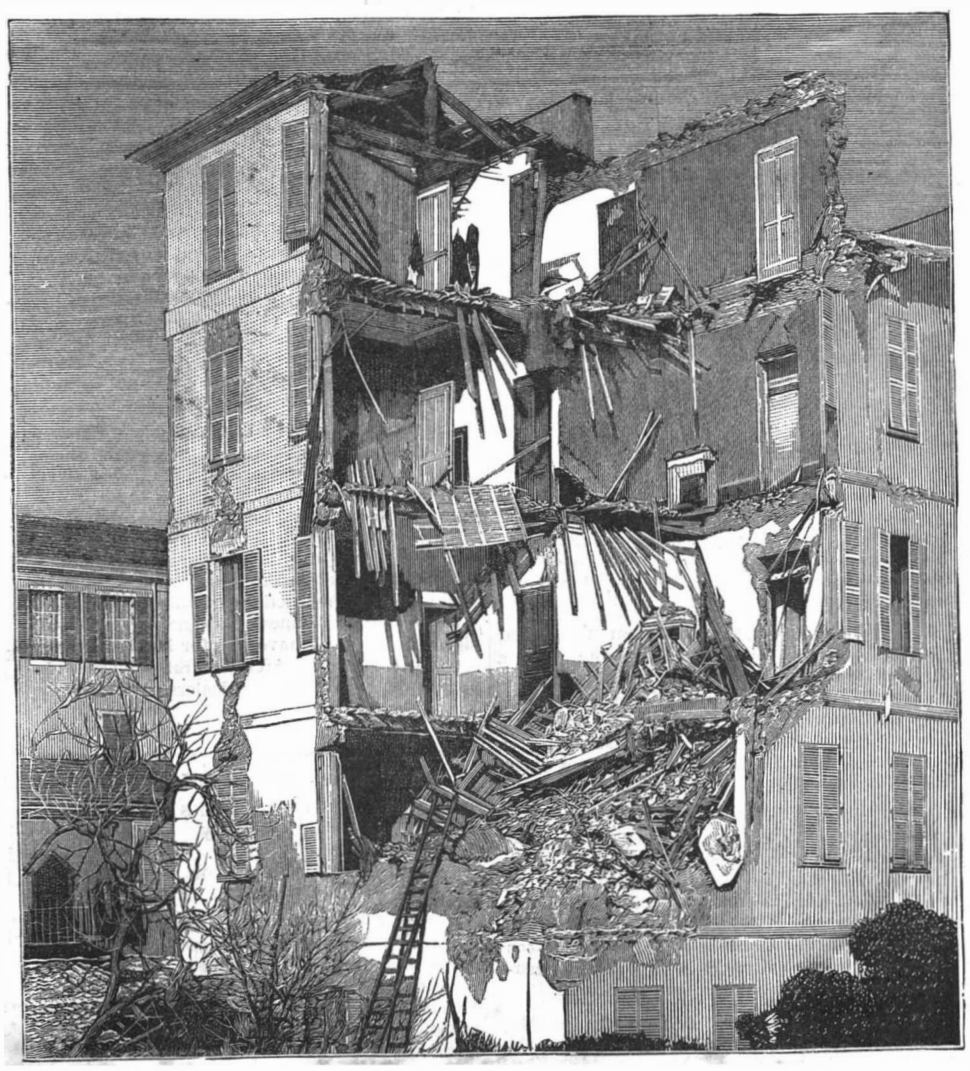
At Mentone, the head Post Office and the villas Cipollino and Molinari are in ruins. The earthquake at Mentone is described in the following letter to us from Lieutenant-Colonel A. F. Bingham Wright:

"Just as the day was breaking, on Ash Wednesday, we were roused from our sleep by a fearful noise and by the violent shaking of the room, with the crash of falling masonry and breaking glass and china. There was, of course, no doubt about the cause. It was an earthquake shock, and one of the most violent I ever experienced; and I expected every moment to find the house falling with us. We dragged our little boy out of his bed, fortunately untouched by the falling rubbish, and rushed for the stairs just as we were, for there seemed no time to spare, if we wished to get down alive. Having got the child down in safety, we returned to aid our friends, and found a gentleman and his little girl were both buried under the debris, in rooms close to ours. With frantic exertions, they were both recovered; the father much hurt, but the child, most providentially, quite uninjured. She was completely covered, not merely by loose rubbish, but by masses of stonework so heavy that the ladies who were trying to rescue her had not strength to move it. I helped them with all my might, and we were fortunate enough to get at the right spot to find her, and to get her out before she had suffered from want of air. While we were doing so, another severe shock came, but, fortunately, not enough to add much more to the ruin, and, in a short time, all were out of doors.

"During the day and night there were frequent shocks, but, as a rule, diminishing in force. I noticed that a wave of disturbance came on about every three hours; but there were other shocks as well. Hardly any one on the west side of Mentone slept in a house that night. We lay on mattresses under the orange trees in the garden of the Hotel de Venise, close by; some under an improvised tent. Though but little mention has been made of Mentone, I believe it has suffered more than any other place on this part of the coast. I have, since the occurrence, passed in daylight along all the Riviera from there to Marseilles, spending some hours at Nice; and nowhere is there a twentieth part of the damage visible. Mentone, in fact, has much the appearance of having undergone a bombardment. It is sad, indeed, to see this lovely place reduced to such a state. The accompanying rough sketches were taken hurriedly in a pocket-book, but may be of interest."

The destruction of houses at Oneglia was considerable, and at Savona; fourteen were killed in those towns. In the province of Porto Maurizio there are a considerable number of villages in the mountainous districts built in terrace fashion upon the side of hills. Scarcely any of these have escaped; the buildings on the upper slopes first collapsed, and crushed down on those below. At Bajardo, a small town of about 1500 inhabitants, when the first shock was felt, the inhabitants, men, women, and children, rushed in mad affright to the parish church, where, upon their knees, they implored divine protection. The priests moved about among the terrified people, trying in vain to calm their fears. Suddenly a severe shock caused the massive walls of the church to bulge, and in another moment the edifice collapsed, burying beneath its ruins several hundred people, of whom nearly 300 were killed or terribly mutilated. At Bussano, a village of 800 inhabitants, successive shocks razed to the ground nearly every house, and beneath the ruins lie one-third of the population, with no prospect of rescuing any alive. At Diano Marina, most of the houses fell, killing 250 persons.

In the city of Genoa, the ducal palace and other houses were damaged. At the Carlo Felice Theater a masked ball, the crowning fete of the Carnival series, was in progress. The first shock caused a panic; the dance was instantly stopped, and the fantastically dressed people flocked into the streets. Beyond Savona all railway traffic has been suspended; in several places huge masses of stone, loosened from overhanging cliff-brows, threaten to fall at any moment. No further shock occurred after the night of Wednesday, February 23.—*The Illustrated London News.*



EFFECT OF THE EARTHQUAKE AT THE ECOLE MATERNELLE AT ST. ETIENNE.

Furniture Polish.

The subjoined simple preparation will be found desirable for cleaning and polishing old furniture: Over a moderate fire put a perfectly clean vessel. Into this drop 2 ounces of white or yellow wax. When melted, add 4 ounces pure turpentine; then stir until cool, when it is ready for use. The mixture brings out the original color of the wood, adding a luster equal to that of varnish. By rubbing with a piece of fine cork, it may, when it fades, be removed. —*Eclectic Medical Journal.*

AN English and American syndicate is formed to work the coal fields in Zacatecas, Mexico.

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ENGINEERING INVENTIONS.

A car seat has been patented by Mr. Uriah Smith, of Battle Creek, Mich. It has a reversible back linked pivotally to the arms, and a head rest connected pivotally to the ends of the seat back, so that when a passenger leans against the seat back the pressure has the effect to lock the head rest securely in place.

A furnace for steam boilers has been patented by Mr. Zachary T. Reno, of New Orleans, La. It is so built that a fan forces a mixture of air and gas from the smoke stack through a tube into hollow perforated grate bars, discharging the same directly into the fire, thus facilitating complete combustion and utilizing the smoke and gases.

An electric railway signal has been patented by Mr. Charles D. Tisdale, of Boston, Mass. It is an improved arrangement of circuits, relays, and signal magnets, for displaying a signal when a train enters a section and withdrawing it when the train leaves the section, there being for each section two or more semaphores, two relays, two batteries, and a line wire with the track rails.

A rail joint has been patented by Mr. Edwin M. Cooke, of Hot Springs, Ark. Combined with two adjacent sleepers and two rails having their ends united midway between the sleepers is a jacket fitting the rails at their juncture and extended down between and snugly against the sides of the sleepers, the ends of the rails being so united as to form practically a single rail, and be also firmly and solidly supported.

A car starter has been patented by Mr. Joseph M. Erts, of Poughkeepsie, N. Y. The axle of the car has sliding clutches and loose gear wheels, each having a clutch to receive the teeth of the sliding clutches, in combination with auxiliary shafts and a coiled spring, with other novel features, whereby the stopping of the car will store up power to assist in its starting.

AGRICULTURAL INVENTION.

A seed planter has been patented by Mr. Jacob W. Van Order, of Arlington, Oregon. This invention covers a novel construction and combination of parts in a machine where the seeds are dropped close after an opening plow, and the soil pressed into the furrows upon the seeds by runners, it being capable of ready adjustment to plant sugar cane, corn, potatoes, etc.

MISCELLANEOUS INVENTIONS.

A fire escape has been patented by Mr. Henry S. Holland, of Wilmington, Va. It consists of a device of a frame and drum with radial projections and a lever, the apparatus being one which can be quickly adjusted and easily used by an unskilled person, in order to regulate the descent of a rope which is calculated to carry a person escaping.

A clothes washer has been patented by Mr. James T. Campbell, of Sugar Grove, Pa. The invention covers a combination of upper and lower cylinders, in which pistons are operated by a crank to force hot air and water through the clothes, by which they may be thoroughly washed with economy of time and labor without injury to the garments.

A letter box has been patented by Mr. Carl F. Teller, of Offenbach-on-the-Main, Germany. This invention covers a letter box and a bag or pouch, which are dependent upon one another, so that one cannot be opened or closed without the other, and the box can be emptied of its contents without the letters being handled by the operator.

A lamp attachment for sad irons has been patented by Mr. Henry C. Fox, of Evansville, Ind. It is adapted for heating a hollow reversible sad-iron, and is calculated to heat the iron more uniformly and perfectly, the construction being such that the flame may be intensified and regulated at pleasure, with other novel features.

A tricycle has been patented by Mr. Charles C. Anderson, of Morgan City, La. The invention consists in attaching to each end of a treadled crank shaft a grooved wheel, whereby motion is communicated to the main crank by means of pitmen, in connection with novel details in the construction of the frame and steering bar.

A pencil sharpener has been patented by Mr. Archibald C. McKinnon, of San Francisco, Cal. It consists of a block with two conical cavities, one lined with metallic plates carrying knives or cutters and the other lined with sandpaper, the cutters for removing most of the lead and wood as required, and the sandpaper for finishing.

A lounge has been patented by Mr. Henry Burgess, of Chicago, Ill. It is a piece of furniture jointed together in such manner as to form a box, with a hinged seat, which is the cover of the box, making a receptacle for dresses and other articles, while it can be taken apart for convenient transportation and storage.

A heat regulator has been patented by Mr. Mifflin W. Baily, of Pottstown, Pa. It is a register with two openings controlled by a valve and adapted for connection by pipes with the smoke pipe and ash pit of a furnace, so that the draught of the furnace may be regulated from the apartment within which the heat is delivered.

A journal for milk separators has been patented by Mr. Peter Peterson, of Reinbeck, Iowa. It consists of an axle fitted in a bearing and supported by a steel disk, resting on a ball supported by a second disk, and fitted in a recess in the bearing, the ball having so little frictional contact that it is not liable to get hot, and always centrally supporting the axle.

A cash carrier has been patented by Mr. Joseph Starr, of New London, Conn. It has a buffer bar loosely held and provided with springs, so that the car can receive no injury from coming in contact with the stop blocks, a slight forward movement of the hand upon the lever causing the car to traverse the wire, and the device being cheap of construction.

A wash bench has been patented by Mr. Otis Shepardson, of Sturgis, Mich. It has two standards to receive the mechanism of a wringer, with other short standards on either side pivoted to longitudinal bars, so that they can be folded up, and when opened out will constitute a bench for a wash tub on each side of the main standards.

A mould for casting printers' leads and small furniture has been patented by Mr. Gustavus F. Kimball, of Topeka, Kansas. It is a mould wherein the side bars or formers are reversible and detachable, and united to clamps on either side by tongues and grooves, so that any form of leads, slugs, or small furniture can be cast expeditiously.

A foot rest for stoves has been patented by Gertrude H. Woodworth, of Algona, Iowa. It consists of a frame to receive the upholstered upper surface of a foot rest, the under side of the frame having clamping arms adapted to attach to the foot rail of a stove, and the portion of the footstool adjacent to the stove being protected by a zinc strip.

A combined deck and dumping scow has been patented by Mr. Franklin P. Eastman, of New York City. It has sliding hinged doors, inclined floors leading to the sides of the doors, which form either a part of the deck on each side or a peaked section in the center of the scow, with devices for sliding, opening, and closing the doors, and other novel features.

A tap valve and tapper for casks has been patented by Mr. Richard Teichmann, of Brooklyn, N. Y. A spring valve is arranged in the tap hole of each barrel or cask as a permanent fixture, and there is furnished therewith a special opening or tapping device fitting over the valve seat and drawing the spring valve open by means of a hook and a latch or lever.

A device for winding up counterweights has been patented by Mr. Victor Popp, of Paris, France. The invention consists of a system of automatically winding up counterweights for transmitting or accumulating power by the employment of a fluid, liquid, vapor, or gas, under a constant or variable pressure, the apparatus embracing a variety of novel features.

A crown piece for bridles or halters has been patented by Mr. Daniel T. Chambers, of Mansfield, Ohio. All the parts of the crown piece are stamped by a die out of a single piece of leather, which is made in such shape that it can, on dampening, be readily moulded into the best natural form, while avoiding the expense of stitching and the discomforts to the horse of lapping joints.

A wagon brake has been patented by Mr. Noble E. Thompson, Jr., of Clark's Mills, Pa. The invention covers a novel construction and combination of parts for a brake designed to automatically lock the wagon when stationary, applied draught automatically removing the brake, and when descending a hill the action of the horses in holding back tending to apply the brake with increased force.

A snow plow has been patented by Mr. Almeran Roberts, of Hanover, Me. It consists of a strong timber frame, the forward portion carrying adjustable cutters, and the rear portion carrying scrapers, the design being to break up and distribute the snow over the roadbed, and press it down to form a compact and even road, displacing the greater portion and leaving only enough for use in the road.

A shoal water alarm has been patented by Mr. Louis Frik, of Philadelphia, Pa. The invention covers the combination of an electric circuit and signaling devices with conducting lines, in connection with a small anchor which is suspended at any desired depth, but on striking the bottom establishes an electric circuit and causes a bell to ring which indicates that the vessel is in shoal water.

A flaxseed separator has been patented by Messrs. Lorenzo S. Welker and Harry Kiffe, of Beaver Creek, Minn. The construction is such that an air blast strikes the sheet of flaxseed as it falls from the hopper, and carries away straws, stems, etc., while the screen upon which the seed falls has apertures to allow the flaxseed to pass through, but will not pass kernels of grain, large seed, etc.

A clamp for holding plowshares has been patented by Mr. George W. Thorp, of Conway Springs, Kansas. It is a clamp that allows a pivotal as well as a sliding movement, for holding the two wings of a plowshare together during welding or sharpening, so that when the wings are placed in proper relative position for welding, the clamp will prevent any slipping.

A hay press has been patented by Mr. William A. Laidlaw, of Cherokee, Kansas. This invention covers an improvement in that class of presses known as perpetual or continuous, with followers operated by a reversible sweep, allowing them to be thrown back by the elastic rebound of the hay or other material to be pressed, and embraces a novel construction and combination of parts.

A seam dampener has been patented by Mr. Frank Baldwin, of New York City. It is a device so made as to form a miniature hand fountain, having at its lower end a valve and spindle, the latter arranged to operate the valve and run in contact with the garment, so that slight pressure will open the valve and permit a flow of water, for convenient use in laundries, etc.

Wall paper forms the subject of a patent issued to Mr. William Campbell, of New York City. This invention covers the ornamenting of the paper with dry pulverized coloring material, coating the surface first with glue or other adhesive, and then sprinkling the colors while the paper is at the same time beaten from the under surface and made to travel continuously, giving solid colors in part and variegated ones in part, of a rich and handsome appearance.

A puzzle has been patented by Mr. Henry Oellrich, of Detroit, Mich. It consists of two leaves of pasteboard so connected by straps that when the leaves are opened the straps act as hinges, one pair being near opposite ends of the leaves, the other pair near the center, and having two similar folding packages, one on one side of the inner straps and the other on the opposite side, so that either package may be exposed by the holder without detection by the casual onlooker of any deception.

A billiard ball has been patented by Mr. George E. Phelan, of New York City. It is a combined ivory and composition ball, the ivory core having a protective covering or layer, of celluloid, zylonite, or other fibrous material, the core being of such size as to perfectly maintain the shape of the ball, using but little composition, but making the balls cheaper, as old balls can be returned and thus used as well as smaller pieces of new ivory.

A billiard table cushion has also been patented by the above inventor. It is an India rubber cushion, having a tube placed in a longitudinal perforation near the operative edge, the tube being made of band rubber, gutta percha, celluloid, metal, or other suitable material, and operating to distribute the force of the impact of the ball, and supplement the elastic spring of the rubber cushion.

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SANITARY EXAMINATIONS OF WATER, AIR, AND FOOD. By Cornelius B. Fox, M.D., F.R.C.P. Lond. Philadelphia: P. Blakiston, Son & Co. 1887. 110 illustrations. Pp. 563.

The title of this work expresses prettly accurately its contents. It is stated to be designed for the use of medical health officers. The different methods for determining organic matter in water, such as Frankland's, Wanklyn & Chapman's, and the permanganate test, are treated of. Koch's determination of bacteria is briefly described, but is considered rather outside of the scope of the work. Solid residue, chlorine, hardness, and all the prominent factors in water analysis find a place in the work. Practical points as to the time required in performing analyses, keeping records, form of report, etc., are spoken of at length. The analysis of air for carbon oxides, for sewage emanations, etc., forms an interesting part of the book. Food analysis is the concluding subject. About an equal number of pages are devoted to water and to air analysis respectively, and about half this space to food analysis. The appendix contains lists of apparatus, chemicals, useful tables, etc. An index closes the book. The illustrations are chosen with judgment, and form a thoroughly useful part of the work.

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Billings' Patent Adjustable Four and Six Inch Pocket Wrenches. Billings & Spencer Co., Hartford, Conn.

Curtis Pressure Regulator and Steam Trap. See p. 45.

Pat. Geared Scroll Chucks, with 3 pinions, sold at same prices as common chucks by Cushman Chuck Co., Hartford, Conn.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) W. C. H. writes: 1. About what is the air pressure on a window glass when the weather outside registers zero and temperature inside is at 100° Fah.? How hot would it require to be for outdoor air pressure to break common window glass, say 24 by 36 inches? A. The difference in pressure due to difference in weight of air at temperatures given would be slight. It would not be possible to make such difference great enough to break the glass, but the difference in tension on the glass from variations of temperature sometimes causes breakage with comparatively small changes in the weather. 2. How is prepared glue made? A. See answer to query 14 in SCIENTIFIC AMERICAN of February 26. 3. What does the small letter "M" on the silver dollar denote? A. It is the initial of a die cutter, Morgan, and is on but few coins. Other letters on coins are known as mint marks; they are not on all coins, and not on those from the Philadelphia mint, which does the largest proportion of the coinage. "O" is the mark of the New Orleans mint, "S" that of the San Francisco mint, "C C" that of Carson City, etc. 4. What is the difference in speed of the travel of a rifle ball and sound? A. Sound in air travels at the rate of about 1,000 feet a second, the speed varying considerably with the volume or loudness of the sound. The velocity with which a ball leaves the rifle will vary from 1,500 up to 2,200 feet per second, according to the charge of powder, weight and shape of projectile, etc.

(2) H. J. D. asks (1) what cement to use when joining carbons to top of jar in a bichromate battery, by means of brass plate, so the acid will not ruin it. A. You may fasten the carbon by brass lugs secured by bolts and nuts; before doing this, the upper end of the carbon may be soaked in melted paraffine. Or, you may copper-plate the top of the carbon after the immersion in paraffine, and then dip into melted type metal. This gives a good bearing surface for the lugs, or they may be soldered to it. 2. How to keep brass bright after polishing it? A. Lacquer it with some approved lacquer. 3. What is the best material for soldering brass? A. A solution of chloride of zinc made by dissolving zinc to saturation in muriatic acid is generally used. The addition of a little sal ammoniac improves this. Lactic acid is also used.

(3) L. S. asks: 1. In the induction coil described in No. 160 of the SUPPLEMENT, what is the object in having bare copper wire in the secondary coil, and will not insulated copper wire give as good results? A. Bare copper wire is used to save space. Otherwise, covered wire will answer just as well. 2. Will the length of the spark be increased if the coil be made 2 or 3 inches larger, and a larger amount of wire in the secondary coil be used? A. The larger the core, the longer will the sparks be. 3. If made larger, would not three layers of No. 16 wire be better than two layers for the primary? A. Three layers might be advantageous if the coil was larger. 4. Is the coil dangerous, using 10 or 12 small bichromate potash cells, and will the effects of the coil increase with the battery power? A. The danger of using too high a battery power is that the insulation will be injured, and its effects increased to a certain extent with increased battery. 5. Will common thick white wrapping paper do for between the tinfoil in the condenser? A. For the condenser, you should use light paraffined paper.

(4) R. A. writes: Say there are two cable street car companies, A and B, and A puts down his road first, then B wants to cross A's line, how is it done without inteference? A. A special device of two connected grips on a car, for this purpose, was illustrated in the SCIENTIFIC AMERICAN, vol. liii., No. 11.

(5) E. J. M.—Copper, brass, or iron moulds are used for casting the valves, seats, and stuffing boxes of dry gas meters. Oiling is not necessary. If oiled to prevent sticking, the oil should be very thinly put on with a brush. The composition is tin and antimony—5 parts tin, 3 parts antimony. Diaphragms should be as nearly alike as possible, and the dials made to match the measure.

(6) J. A. P., York Corner, Me., asks: 1. Is there any cement or other method for sticking rubber to brass? A. Fuse together equal parts of gutta percha and pitch. Use hot. 2. Will rubber freeze so as to break? A. Rubber when exposed to undue cold loses its property of elasticity, and becomes stiff. See "Characteristics of Rubber," in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 249, 251, and 252.

(7) G. S., Ogdensburg, N. Y., asks (1) how to make percussion powder used in gun caps. A. 100 grains of fulminating mercury are triturated with a wooden muller, on marble, with 30 grains of water and 60 grains of gunpowder. This is sufficient for 400 caps. 2. A good flux for general soldering. A. Resin for tin, chloride of zinc and sal ammoniac for iron and brass.

(8) S. S. K. asks: 1. What is the enamel, and how is it baked, on bicycles? A. It is japan varnish made of gums and oil, and is baked in an oven heated to 260°. 2. What is the liquid enamel also used for bicycles, but just applied with a brush, cold? A. Air-drying black varnish—ordinary carriage varnish mixed with lampblack.

(9) M. N., Newark, N. J., asks: How can I remove warts? A. Moisten the warts, and rub sal ammoniac well on them every night and morning.

(10) L. G. G. asks: 1. Is alcohol explosive? If so, under what circumstances? A. Alcohol evaporates at a comparatively low heat, and gives off an inflammable vapor. This suddenly lighting sometimes produces a slight explosion; a mixture of this vapor and air is explosive. 2. Is there danger in using an alcohol lamp, and if so, under what circumstances? A. The danger in using an alcohol lamp is that the vapor of alcohol may inflame. A good fitting wick tube, and a low temperature in the body of the lamp, are the conditions of safety. 3. Is wine or grain alcohol more or less dangerous than wood alcohol? A. Wood alcohol evaporates at a lower temperature than ordinary alcohol, and hence is more dangerous. 4. Is wood alcohol as good to use in a lamp for soldering as grain alcohol? A. It is not as good, as it will give a less quantity of heat per gallon. 5. What are the objections, if any, to wood alcohol for such purposes? A. The very disagreeable odor and the greater danger are the objections. 6. What is the cost of grain alcohol, and what is the cost of wood alcohol? A. Grain alcohol, 95 per cent, $2.30 per gallon; wood alcohol, $1.25 per gallon. 7. What class of tradesmen sell wood alcohol? A. Dealers in chemicals, and also special houses.

(11) E. N. A. asks: Will you please answer in your paper whether the playing of a mouth instrument spoils the voice for singing? A. The question is still undecided. 2. Is wood engraving a good trade, and are there many in it? A. Wood engraving is a good trade, except that it is gradually being displaced by process work.

(12) F. A. B. asks if water has any more attraction than land for a bullet or stone being fired over it, and what that attraction is. A. Water has less attraction, owing to its lower specific gravity. The difference is very slight for existing conditions of land or sea.

(13) D. N. G. asks whether plaster of Paris will stand more heat than iron. A. Plaster of Paris, when set, will stand very little heat; far less than iron.

(14) D. A. writes: Will you please give me a good prescription, through your valuable issue, for a person who has lost considerable flesh and strength. I have no disease of any kind, but still I am very weak. A. Consult a physician. Try a good emulsion of cod liver oil if you can take it.

(15) H. G. H. asks: What is the difference between the British quart and the American quart? A quart of water in England weighs 20 ounces, I believe. What does it weigh here? A. The Imperial pint contains 34·659 cubic inches, its contents in distilled water weighing 8,750 grains. The American pint contains 28·8 cubic inches, weighing in distilled water 7,291⅔ grains. The Troy ounce contains 480 grains, the avoirdupois 437½. The Imperial pint contains 20, the American a little over 18 ounces, avoirdupois.

(16) B. M. asks: What is an arpent in dimensions? A. The arpent was an old measure for land. It had different values. An arpent by one standard was equal to five-sixths English acre.

(17) J. W. P. says: We are frequently troubled in our press room by paper sticking together, both in feeding and in straightening, which makes it difficult to handle. Will you please give cause for this peculiar phenomena, and remedy to prevent it? A. Your trouble is caused by electricity. If you print your paper dry, you might try wetting the edges of the paper with a sponge. If that does not remedy the difficulty, take a sheet of Manila paper, oil it thoroughly, and use it as an offset sheet.

(18) T. W. asks: 1. In an electro-magnet, what is the relation between its attractive force and the size of the coils? A. No clear statement of any law can be given, as so many other factors enter into the problem. 2. What size wire will give best results in an electric bell (local), and how large should coils be? A. You will find No. 20 or 24 wire will work well, ¼ to ½ pound in quantity. 3. What is the difference between an electric and a magneto-electric bell? A. There need be no difference.

(19) A. J. K. asks: 1. Please give me directions for making platinum prints, spoken of in some books on photography. A. Platinum prints are the subject of a patent. Address in reference thereto Wilson Hood & Co., 910 Arch Street, or Thomas H. McCollin, 635 Arch Street, Philadelphia. 2. How can I stain wood so as to make it look like cherry? A. Try following:

Alkanet root	15 grains.
Aloes	30 "
Dragon's blood powdered	30 "
95 per cent alcohol	500 "

Mix and let stand in a tightly corked bottle some days. Go over the wood with dilute (1 in 10) nitric acid first. This is pretty dark. You may lighten by using more alcohol. 3. What can I put on a laboratory table made of wood to prevent it from being stained and eaten by acids or alkalies? A. Try silicate or slate paint, such as sold for blackboards.

(20) L. W. writes: I noticed in a silver plating works some time since that the platers dip their wares in a solution to clean and take off the tarnish. They claim it is a solution of cyanide of potassium. Can you give me receipt for this solution, and how to clean the ware? A. A hot solution of cyanide of potassium is used as a dip for articles that have been a few minutes in the electro-plating bath. For full information as to the preliminary cleaning, scouring, pickling, and amalgamating of the articles, we refer you to Fontaine's Electrolysis, $3.50, also Watt's Electro-Metallurgy, price $5.00. These are the best books on the subject. One process is the following: A solution of 1 caustic soda in 10 water is first used; next 1 sulphuric acid in 10 water; after rinsing, a solution of 10 nitric acid (36°), 200 salt, and 200 water is used; next 60 nitric acid, 200 sulphuric, and 200 water. To amalgamate, a dilute solution of nitrate of mercury may be used. These solutions are for dips. The articles are immersed in them and rinsed off between the applications.

(21) F. H. M. writes: Will you please give the method of solving the following problem: A man has a board ten feet long, which is two feet wide at one end and from that tapers to a width of one foot at the opposite end. Where shall he cut it at right angles with the center line, to give an equal area in each section? A. The area of the whole piece is found by multiplying its mean diameter by its length: $\frac{1+2}{2}\times 10=15$ square feet. It is to be cut into two pieces, each of an area of 7½ square feet. Let us take the section at the smaller end. Its small end will be 1 foot across; call its length x. Then, as the board tapers in width one in ten, the large end of the section will measure $1+\frac{1}{10}x$. The mean width will be:

$$\frac{1+(1+\frac{1}{10}x)}{2}=1+\frac{1}{20}x.$$

This mean width multiplied by the length, x, will give the area, which by the conditions of the problem must be 7½. This gives us the equation:

$$(1)\ (1+\tfrac{1}{20}x)\,x=7{\cdot}5.$$

which solved gives us $x=5{\cdot}8110+$ or 5 feet 9·32 inches, or the board must be cut at that distance from the narrow end.

(22) N. S. C. writes asking (1) the rate of expansion or contraction of ice. A. 1000 volumes of ice at 32° Fah. contract to 997½ volumes at —4° Fah. Also see SUPPLEMENT, No. 574, for recent determinations. 2. Also for a cement for bisulphide of carbon prisms. A. For prisms use fish glue with a little glycerine.

(23) A. F. O. writes: Cooling water begins to expand at 39°, and continues to expand till frozen. Does the resulting ice continue to expand by further reduction in temperature? What are the relative volumes of ice at lower temperature? A. See answer to No. 22.

TO INVENTORS.

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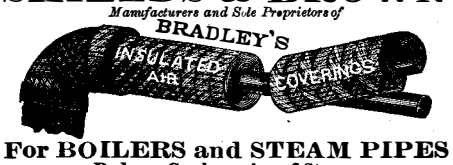

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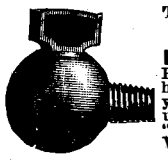

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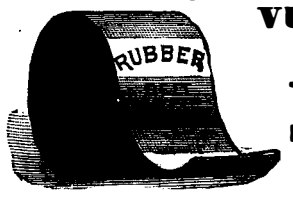

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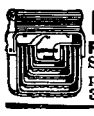

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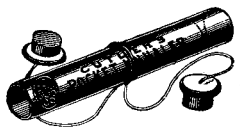

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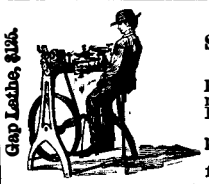

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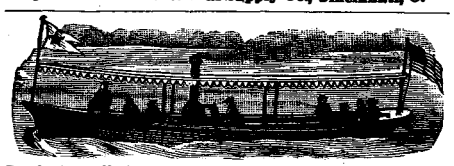

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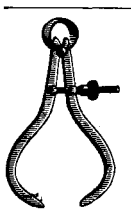

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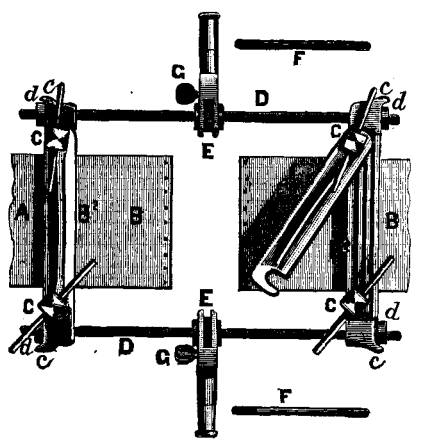

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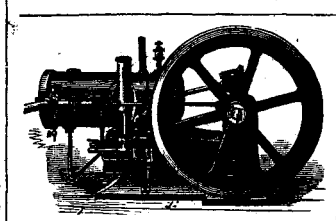

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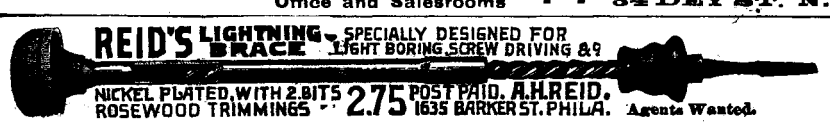

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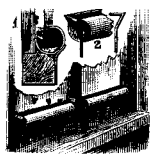

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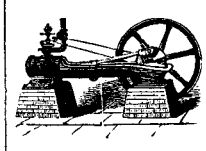

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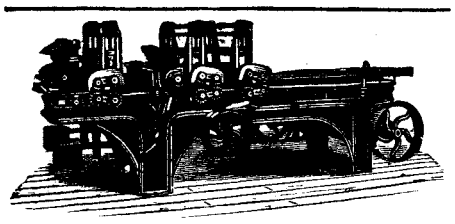

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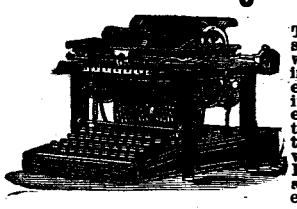

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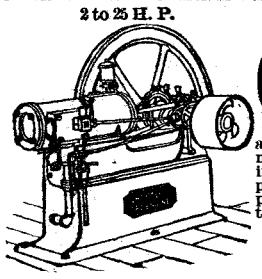

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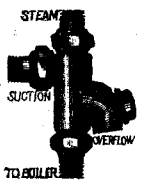

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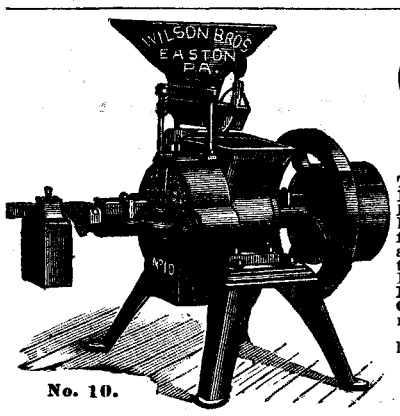

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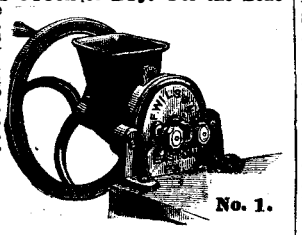

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